

INTERNATIONAL INSTITUTE OF AGRICULTURE
BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

INTERNATIONAL REVIEW
OF THE SCIENCE
AND PRACTICE OF AGRICULTURE

MONTHLY BULLETIN
OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

YEAR VII - NUMBER II
NOVEMBER 1916



ROME
PRINTING OFFICE OF THE INSTITUTE
1916

In quoting articles, please mention this BULLETIN.

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FIRST PART.
ORIGINAL ARTICLES

**Organisation of Agricultural Services
in the French Zone of the Empire of Morocco.**

by
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In Morocco the agricultural question owes its importance to the fact that in an average year 98 per cent of the total exports consist of the produce of the soil.

At the same time that the French occupation was gaining for the native tribes that security which is necessary for all permanent agricultural work, the Intelligence Board (a military organisation) was endeavouring to give a fresh impetus to agriculture by the establishment of demonstration fields and nurseries, by seed distribution etc. Appreciable results were obtained, but as these initial efforts could only be applied on a restricted scale, they were insufficient to meet the many needs which arise from immigration and the extension of foreign business.

Agricultural colonisation involved the cooperation of European and native elements in the work of economic improvement and the union of districts that tribe rivalry had hitherto kept in isolation. Under these circumstances, it was inevitable that various technical and administrative problems should arise. Consequently it was necessary to form a central organisation attached to the General Residence in order to secure some measure of uniformity and permanence in matters connected with agriculture and stock breeding. The Agricultural Board was established on April 1st 1913 and its general programme may be analysed as follows:

- 1) To study the natural conditions of plant and animal production;
- 2) to encourage improvement in native agriculture to the same degree as in neighbouring colonies;

- 3) to advise and aid the colonists ;
- 4) to prepare the way for future progress by scientific investigation ;
- 5) to study the problems of agricultural hydraulics and improvement of land ;
- 6) to aid in the organisation of professional agricultural teaching ;
- 7) to establish administrative relations with the Chambers of Agriculture and with the Agricultural Societies and Committees.

In order that this programme might be more efficiently carried out the Agricultural Board was extended and developed in 1915 into the Department of Agriculture, Commerce and Colonisation, which now includes branches for Agriculture, Stockbreeding, Hydraulics and Agricultural Improvements, Colonisation, Research and Education, and also the official chemical laboratory for the analysis of samples.

The Agricultural branch, with which we are specially concerned here, includes a central board and a regional technical board.

Central Board. — This consists of :

- 1) an administrative staff which is concerned with office work and the study of legislative measures and regulations for the protection and improvement of agriculture.
- 2) a supervising staff which directs and controls the action of the regional board.

Regional Technical Board. — This consists of a technical staff drawn from the ranks of the inspectors and sub-inspectors of agriculture, the agricultural advisers and head and under gardeners.

Inspectors and sub-inspectors of agriculture are stationed in the chief centres (Mequinez, Casablanca, Mazagan, Marakesh), and they act as technical advisers to the military and civilian governing bodies, forming a connecting link with the Central Board in agricultural matters. These inspectors continually travel about the country and so they are able to take part in enquiries and surveys, to gather on the spot much useful information about the economic possibilities of their own areas, to carry out constant propaganda work and to spread information among the natives. They also instruct the colonists and advise them how to set to work, and finally they give to the experimental gardens and demonstration fields a bent which is practical and in line with the interests of the districts for which they have been established.

Every country which is desirous of making agricultural progress nowadays considers it necessary to establish experimental gardens specially adapted for teaching purposes. In West Morocco it has been possible to set up three such gardens at Rabat, Mequinez and Marakesh.

The garden at Rabat has been in working order since April 1st 1914; at first it was about 10 acres in extent, but it has since been granted a further 12 $\frac{1}{2}$ acres. The work of this station is chiefly devoted to kitchen garden and fruit cultivation. These are already among the chief resources of the immediate neighbourhood of Rabat and the coast region, and their importance promises to be still greater in the future. In ad-

tion to this, experiments are being made on the growing of cotton, Riga
ax, ramie, castor oil etc. Special attention has also been given to the
building up of nursery collections which already include a fairly large
number of varieties of fruit, forest and ornamental trees: Algerian olives
and grapes, hybrid vines from the Montpellier School, apricots, peaches,
limes, apples, pears, walnuts, bananas, willows and screen-plants, etc.
brought from South France, Algeria, Tunis and Spain.

The Mequinez garden covers an area of 50 acres and was started in
October 1914; on July 1st the same year the Marakesh station, 75 acres
in extent, was placed at the disposal of the Agricultural Board. These
two stations are given over to the production on a large scale of better
varieties of fruit and woodbearing trees, of local or foreign origin. It
is now possible to distribute a certain number of plants to the natives,
who are the first to recognise the value of the extension of tree growing.
Both gardens, also carry out experiments with commercial plants used
in native industries (textile plants, essential oil plants etc.)

Two Experimental Farms are being set up, one, situated at the Fez
station, is 1 250 acres in extent; the other, about 7 ½ miles from Mazagan,
covers 3 000 acres. They will begin by working along the lines of the
present agricultural campaign, and will be able to deal with the larger
agricultural problems which will present themselves in connection with
future colonisation and which would be outside the scope of the stations
at Rabat, Mequinez and Marakesh. The work will include cereal selec-
tion for increase in yield and greater resistance to disease, the study of
ravage and commercial plants, questions connected with the working of
the soil, utilisation of water, employment of machines, improvement of
livestock employment and education of the labourer. Such problems
as these can only be efficiently dealt with where sufficient land is available
and where the work is carried out methodically and steadily under
the conditions and with the resources that are available on an ordinary
farm.

Meteorology. — A knowledge of the climatic characteristics of the
country is of capital importance and the value of methodically registered
observations has been recognised by the Department of Agriculture,
which has already established 45 meteorological stations in Morocco,
while another dozen are now being set up. The observations already
made have been worked out at Rabat and issued in the official Bulletin,
and they indicate the most important features of the climatology of this
country.

The network of stations will be completed as soon as circumstances
permit and will ultimately include:

- 1) a central station at Rabat, fully equipped with the best apparatus;
- 2) a well-equipped station in each natural district, supervised by
Inspector of Agriculture;
- 3) smaller stations provided with a certain number of instruments;

4) observation posts for the special purpose of measuring rain and temperature.

Improvement of native agriculture. — It will be a work of time study the conditions under which various crops and methods of tillage which have already been proved successful in other countries under similar conditions, can be introduced into Morocco. Organised agricultural experiments were begun at once but several years must elapse before the results are available. It was, therefore, of immediate importance to introduce to the native population simple and practical improvements in the methods of cultivation, most of which are in use in neighbouring colonies. This work has dealt with the pruning of fruit trees especially the olive, in the regions of Mequinez, Fez and Rabat. Native proprietors have repeatedly shown how great an interest they take in our demonstrations and how much they wish for the continuation of the teaching, of which they begin to see the utilitarian value. With such good will and aptitude on the part of the scholars, associations of partners and grafters will soon be formed, who will in their turn spread better methods. In the same way it has been possible to begin to combat the sooty mould of the olive, which is so widely spread in Morocco.

Mechanical mowers, seed sorters and winnowing machines have been placed at the disposal of the different Regions in order to familiarise the native with the use of these implements, which are easily worked and are not expensive. The spread of the practice of cutting and drying hay would bring about a great improvement in the rural economy of Morocco, where the grass is left to dry uncut without profiting anyone. Through the use of seed sorters the natives learn the advantages of sowing uniform seeds, free from weed seeds; they are also taught how to prevent the smut or bunt of cereals by immersing the grains in copper sulphate solution.

Cattle Breeding. — The cattle breeding problems are closely allied to those which arise in the crop production; consequently they have been entrusted to a Board under the immediate authority of the Director of Agriculture, Commerce and Colonisation, with the exception of those questions which concern army horses, which are dealt with by the Metropolitan Board of Studs and Army Remounts. At Casablanca, and under the chief of the Board, a bacteriological veterinary Laboratory is prepared to undertake scientific research on parasitic and other diseases.

The Board of Regional Inspection has a veterinary surgeon in seven centres, i. e. Mechra-bel-Ksiri, Mequinez, Fez, Settat, Marakesh; the veterinary surgeons make frequent rounds for study and enquiry, which give them the opportunity of coming into close relations with the agricultural population and of encouraging better methods of stock management. Epizootic diseases are also under their control, and in co-operation with the municipal veterinary surgeons in the urban centres, the Board provides the Sanitary police for the interior of the country. The inspection of animals and animal products of foreign origin is carried

at the ports by veterinary surgeons provided with special powers and remunerated by visiting and quarantine fees.

The chief steps that have been taken up to the present have dealt with the formation of forage reserves, the establishment of watering places in the chief cattle districts and along the main transport routes, and the building of shelters for the animals. Restrictions have been imposed on slaughtering, so that cows may not be killed under eight years and ewes under five years and steps have been taken against epizootic maladies. Premiums have been offered for cattle breeding, and facilities have been provided by the introduction of picked breeding stock into the country. The formation of a Stud-book and Herd-book is also under consideration.

An ostrich farm exists at Mequinez under the direction of the Veterinary Inspector of the Region.

Laboratory of Agricultural and Industrial Chemistry. — This was established at Casablanca in 1914 and is chiefly concerned with the suppression of fraud and adulteration in food and agricultural products. Even at the present stage of its development this Laboratory has made a useful contribution to the work of the Experimental Stations and Gardens, and this contribution will be still greater in the future.

Hydraulics and Land Improvement. — This Board is in process of formation and will deal with questions of drainage, the best use of water for agricultural purposes etc. The draining of the Merdjans (marshes) which cover a great part of Morocco will bring into use much land of first class quality.

Research and Education. — This branch was at first autonomous, but was united to the Agricultural Board at the time of the transformation into the Department of Agriculture, Commerce and Colonisation. This union was essential because in Morocco (as also in Algeria, Tunis, and Indo-China), agricultural production plays such a great part in affairs that a natural connection has arisen between agricultural and commercial interests, calling for the centralisation of the administrative study of the questions concerned. The Board has Regional Economic Bureaux which collect facts bearing on commerce and industry and study the causes which influence development. These bureaux possess commercial museums exhibiting the chief types of products, both imported and exported.

Colonisation. — This work has been somewhat hindered by circumstances, but the scheme embraces the following types of colonisation:

a) The demands of the towns for fruit and vegetables are continually increasing, and this provides a very favourable opportunity for the establishment of market gardens on the best soils as near as possible to the outskirts of the towns. Allocations of land for this purpose have already been made at Kenitra, Fez, Rabat-Sale, and Casablanca, and others are being considered.

b) As soon as new lines of railways are projected areas of land not exceeding 50 acres in extent will be let out in the immediate neighbourhood of the lines.

c) Provision has been made for the distribution of lots of land from 250 to 325 acres in extent, suitable for conversion into farms. Facilities for payment are given, subject to certain conditions as to working and improvement.

d) The Administration will lend its aid to large estates which are prepared to subdivide their property for the creation of farms for immediate cultivation. For this purpose assistance will be given for the building of communication roads and for the provision of a stock of public implements and machinery.

e) Special areas of land will be reserved for the native elements and efforts will be made to extend the work of the native provident societies in checking usury, and to develop the spirit of cooperation in the buying of seeds, implements and breeding stock.

SECOND PART.
ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

157 - The Agricultural Resources of Indo-China. — BRENDER H. in the *Bulletin de la Société d'Encouragement pour l'Industrie Nationale*, Vol. 126, No. 4, pp. 37-73. Paris, July-August 1916.

Forest Products. — Though there are possibilities of opening up a considerable trade with China in the hard woods, at present there is no timber in Indo-China suitable for export to the European markets with the exception of "lim" (*Erythrophleum Fordii Oliv.*) which is the material used for wood block-paving. Exports of forest products consequently consist almost entirely of bye-products, the principal ones being :

DEVELOPMENT
OF
AGRICULTURE
IN DIFFERENT
COUNTRIES

- Cinnamon.
- "Cimo" (tuberules of the Discorciaceae family from which a dye is obtained).
- Cardamones (fruits of several Zingiberaceae).
- Benzoin.
- Gutta-percha
- Sticklac [1].
- Rattans for fine canework.
- Palm wood for umbrella handles.
- Vegetable lac (obtained by tapping trees of the Anacardiaceae order).
- Oil seeds of *Calophyllum Inophyllum Lin.*, *Camellia drupifera*, *Lour* and *Garcinia*.
- "Abrasin" (a drying oil probably obtained from *Aleurites montana Wils.*)
- Camphor
- Resin (from *Pinus Massoniana*).

Mangroves abound on the coast and might be made to produce considerable quantities of bark of an exceptionally high tannin content, some samples having yielded up to 24 to 25 per cent of tannin.

[1] See *B. August 1916*, No. 895.

Animal Products. — It would probably be possible to develop an export trade from Cambodge and Southern Annam. Exports of raw hides had already reached 3000 tons in 1913.

Food Stuffs. — After Burmah, Indo-China is the most important rice exporting country in the world and judging from the results obtained at the Experimental Station of Buitenzorg (Java), the production could be raised 50 per cent by the use of improved varieties. Maize is now being grown for export and an experimental ground has been set aside in Tonkin to investigate problems in connection with this crop. Small quantities of manioc and arrowroot are put on the market and could well be increased. Various kinds of pulse crops have been tried with success in Tonkin, the most popular at present being gram (*Cicer arietinum*).

Tropical fruits give promise of great future developments. With cold storage facilities, mangoes, mangostans and pineapples could easily be put on the European markets, while a profitable commerce could no doubt be established in preserved papaya fruit (valuable for its peptic ferment papain) and dried "letchis" (*Nephelium Lit-Chi*). Coffee and tea have been successfully planted and may become important in the more or less remote future, but cocoa is at present almost unknown in the colony, though suitable localities for its growth exist in Cambodge around the Gulf of Siam. Pepper is already being exported in considerable quantities, and so is cane sugar, though the latter industry is not in a very flourishing condition, its only experimental station (in central Annam) having been recently shut down.

Fibres. — Cambodge cotton is of a good fine quality though not up to Louisiana varieties in length of fibre and tensile strength. It is exported to Japan. Good progress has been achieved in the silk-worm industry and Tonkin silk now competes with Canton products on the European markets. The Experimental Station at Phulangthoung distributes selected grains from which yields of 1 lb. of silk per 13.5 lbs of cocoons have been obtained or about twice as much as the native varieties produce.

Jute has been given a long but unsuccessful trial in the colony, *ta* (*Boehmeria nivea* and *B. tenacissima*) is found sporadically, and *Hibiscus cannabinus* is indigenous to the country but its cultivation does not offer commercial openings at the moment. Kapok is obtained from *Eriodendron anfractuosum* and *Bombarium malabaricum* and is exported together with cotton.

A certain amount of material is sent to Europe for the rush and cane industries, i. e. various rushes, rattan canes and the leaf fibres of palm *Livistona sinensis*, *Chamærops* etc. Bamboo pulp for papermaking is now being manufactured at Vétri, a place situated at the junction of the Red and Claire Rivers.

Oils and Fats. — Copra is produced in Cochin-China, ground-nut in central Annam and castor oil seed in Tonkin. The colony also exports sesame seed and hevea seed which contains about 42 per cent of a dry oil somewhat similar to linseed oil. There are districts in Upper Tonkin where hemp and colza could no doubt be grown with success.

Various Other Products. — The most important of these is plantation rubber. In 1913 as much as 29 300 acres were under heveas, representing capital sunk to the value of £ 800 000. Exports in 1914 amounted to 180 tons.

Finally as worthy of possible future developments the following materials should be mentioned: tobacco, to be grown for the French Government monopoly; various essential oils and extracts such as badian, citronella, vetiver, lemon grass, ylang-ylang, galangal, camphor; catechu; Coca; and lastly agar-agar to be obtained from certain seaweed beds on the coast of Annam.

1153 *Agriculture in Switzerland.* — I. DESERENS E., *Les améliorations foncières en Suisse*, in *La Vie agricole et rurale* Year VIII, No. 36 (Special number on Swiss agriculture), pp. 161-164. Paris, September 2, 1916. — II. BORGEAUD A., *Le bétail bovin en Suisse*. *Id.*, pp. 161-172. — III. FREY J., *Les coopératives d'élevage du bétail en Suisse*. *Id.*, pp. 173-175. — IV. BOUDET D., *La chèvre en Suisse*. *Id.*, pp. 176-180. — V. PORCET F., *La viticulture en Suisse; ses rapports avec l'Etat*. *Id.*, pp. 183-185. — VI. *Le régime des forêts en Suisse*. *Id.*, pp. 184-185. — VII. PENEVEYRE F., *La culture fruitière à la montagne, spécialement dans les Alpes et le Jura Vaudois*. *Id.*, pp. 186-188.

The area of cultivated land in Switzerland is so limited and its value so high that the State takes an active interest in all schemes of reclamation or improvement. A government service has been instituted for the purpose of assisting any such schemes and the writer is at the head of the section for the canton of Vaud.

All the available arable land is liable to flooding and to damage by sion and landslips. For this reason as early as 1807-1808 the Federal government took part in the first scheme for the regulation of waterways, i. e. the embankment of the River Linth. Since then it has assisted in the work of regulating the water system of the Jura and its adjoining plains, and in many other schemes of a similar nature. During the period 1872 to 1911 the federal inspectors of Public Works sanctioned the expenditure of no less than £ 9400 for such purposes. The results have been excellent for the Canton of Saint-Gall, in three cases the value of the aid has been raised to the extent of £ 27 per acre, while in the valleys of the Rhine, Linth and Seez an expenditure of £ 52 000 actually produced improvement valued at £ 134 000.

Drainage was first practised about 1850 and two years later Friburg passed a law making the drainage of bogs compulsory. In some cantons plomas were granted to men who showed special proficiency in such work.

Over the whole of Switzerland, peasant proprietors are the rule and their holdings are very small. Out of a total of 252 496 holdings 201 919 range from 1 to 2 $\frac{1}{2}$ acres, and not only are they too small but each holding consists of several scattered plots, the 201 919 in question being made up of nearly three million plots averaging 0.6 of an acre each. In some cantons the necessity of redistributing the area has been felt for the past thirty years, and the idea has gradually been extended over the country, so that now, if in any part of Switzerland two thirds of the holders, holding no less than one half of the land between them, agree to make

a rational redistribution of the land they have the legal right to enforce the reform.

The improvement of the mountain holdings is encouraged not only by the federal and canton governments, but also by numerous associations formed for that purpose. Such improvements consist in draining, harrowing and manuring the soil; in collecting and removing stones; the building of roads, houses and farm buildings; in the putting up of fences; and in the regulation of surface water. Between the years 1885 and 1912, over £ 560 000 was spent on work of this kind.

With regard to the granting of financial assistance for the various schemes for agricultural improvements and reclamation, the Federal Government goes on the principle of helping those who help themselves and only subsidises schemes towards which the cantons have contributed only half the estimated cost. The distribution of grants and subsidies since 1885 has been as follows:

	Total cost	Sum contributed by	
		Federal Government	Canton Government
<i>Lowland reclamation 1885-1912:</i>			
Drainage and irrigation (53 000 acres)	532 000	155 000	126 000
Construction of roads (140 miles) . . .	91 000	26 000	18 500
Redistribution of land among small-holders (170 000 acres)	112 000	41 000	29 000
Other improvements	93 000	25 000	20 000
	828 000	247 000	193 300
	464 000	162 000	109 000
<i>Mountain reclamation.</i>			
	<u>1 392 000</u>	<u>409 000</u>	<u>302 300</u>

Since 1893 the Federal Government has also undertaken to part of the salaries of the agricultural experts engaged by the cantons.

II. — The total head of live stock in Switzerland has been valued at £ 28 000 000 and the importance attached by the government to this branch of agriculture is shown by the fact that the state grants a sum of £ 40 per annum for the encouragement of pure breeding.

In all live stock shows, judging is carried out exclusively by system of score cards, a sample of which is given in the adjoining table and great stress is laid on pedigree which counts for half the total number of possible points, as follows:

Out of 100 possible points,			
16 points	are allowed for the 2 parents or 8 points for each		
16 points	" " " 4 grandparents or 4 points for each		
16 points	" " " 8 greatgrandparents or 2 points for each		
48 points	" " " whole pedigree.		

Good measurements for 2 years old animals		No.		Good measurements for 3 years old and more		No.	
Born	Permanent dentition	Born	Permanent dentition	Born	Permanent dentition	Born	Permanent dentition
Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.
Max.	Max.	Max.	Max.	Max.	Max.	Max.	Max.
HEAD.....	3	HEAD.....	5	HEAD.....	5	HEAD.....	10
NECK.....	3	NECK.....	5	NECK.....	5	NECK.....	3
Chest, length.....	3	Chest, length.....	4	Chest, length.....	4	Chest, length.....	2
Chest, depth.....	3	Chest, depth.....	4	Chest, depth.....	4	Chest, depth.....	3
Chest, width.....	3	Chest, width.....	4	Chest, width.....	4	Chest, width.....	3
Withers and shoulder.....	5	Withers and shoulder.....	6	Withers and shoulder.....	7	Withers and shoulder.....	4
Line of the back.....	5	Line of the back.....	6	Line of the back.....	7	Line of the back.....	4
Back, belly and flank.....	5	Back, belly and flank.....	6	Back, belly and flank.....	7	Back, belly and flank.....	4
Width of hind limb.....	2	Width of hind limb.....	3	Width of hind limb.....	3	Width of hind limb.....	2
Width of hip joint.....	2	Width of hip joint.....	3	Width of hip joint.....	3	Width of hip joint.....	2
Shape and angle of croup.....	2	Shape and angle of croup.....	3	Shape and angle of croup.....	3	Shape and angle of croup.....	2
Attachment of tail.....	4	Attachment of tail.....	5	Attachment of tail.....	6	Attachment of tail.....	4
Lateral extent of hindquarters.....	4	Lateral extent of hindquarters.....	5	Lateral extent of hindquarters.....	6	Lateral extent of hindquarters.....	3
Limbs:		Limbs:		Limbs:		Limbs:	
Forearm and leg.....	2	Forearm and leg.....	3	Forearm and leg.....	4	Forearm and leg.....	4
Shinbones and hocks.....	3	Shinbones and hocks.....	4	Shinbones and hocks.....	5	Shinbones and hocks.....	3
Pasterns and hoofs.....	3	Pasterns and hoofs.....	4	Pasterns and hoofs.....	5	Pasterns and hoofs.....	3
Cartilage.....	3	Cartilage.....	4	Cartilage.....	5	Cartilage.....	3
SKIN AND HAIR.....	5	SKIN AND HAIR.....	5	SKIN AND HAIR.....	5	SKIN AND HAIR.....	5
COAT COLORATION.....	5	COAT COLORATION.....	5	COAT COLORATION.....	5	COAT COLORATION.....	5
FORMATION OF SKELETON.....	5	FORMATION OF SKELETON.....	5	FORMATION OF SKELETON.....	5	FORMATION OF SKELETON.....	5
Length of bone.....	6	Length of bone.....	7	Length of bone.....	8	Length of bone.....	6
GROWTH AND DEVELOPMENT (weight).....	5	GROWTH AND DEVELOPMENT (weight).....	6	GROWTH AND DEVELOPMENT (weight).....	7	GROWTH AND DEVELOPMENT (weight).....	6
Total.....	100	Total.....	100	Total.....	100	Total.....	100
Pedigree.....	50 %	Pedigree.....	50 %	Pedigree.....	50 %	Pedigree.....	50 %

Outside crosses are not encouraged and improvement is obtained by the method of selection and in-breeding.

The characteristics of the four chief Swiss breeds—Simmenthal, Schwitz Friburg and Herens—are given in this article as well as their geographical distribution in the country.

III.—There are 850 cooperative live stock societies in Switzerland (1) amongst which the two chief breeds, Simmenthal and Schwitz are distributed in about equal numbers.

IV.—Swiss goats have long had a very good reputation abroad and exports of the Toggenburg breed to England were begun as early as 1888. During the nineties goats were much improved by a careful selection of breeding stock without bringing in any foreign blood. The four chief breeds are: the Valaisian or Black Neck, the White Saanen or Gessenay the Alpine, and the Toggenburg. There are a number of goat clubs and during the years 1908 to 1910 the Federal Government granted the following bonuses to prize animals:

£ 490 to 1184 animals in 1908.

£ 550 to 1225 animals in 1909.

£ 650 to 1335 animals in 1910.

Swiss goats yield on an average 150 to 180 gallons per annum. In the valleys they are kept by the smallholders and graze the land near their homesteads, but on the higher ground there is usually a village goat-herd who collects the animals every morning and takes them to the upland pastures for the day, bringing them home again each evening. There are 113000 herds in Switzerland averaging 32 goats per herd. Active export trade is done with Germany where the Swiss breeds have given excellent results when crossed with the local German goats. Trade will probably be extended to France for the improvement of especially of those breeds found in the Central Plateau.

V.—The area of land under vineyards only amounts to 60 000 acres in Switzerland, yet there are two experimental stations set aside for pure viticultural work. One is the Federal Station at Wadenswil and the other is run by the canton of Vaud at Lausanne. In other parts of the country special instruction is given in the form of short temporary courses while the Federal Government contributes to by paying one half the cost. Assistance is given by canton and Federal Governments to all cultivators who are willing to take protective measures against diseases such as mildew, or to insure themselves against damage by hail. Important subsidies are granted too for reconstituting the vineyards (*i. e.* replacing vines which are either attacked or liable to attack from phylloxera varieties grafted on resistant American stock). Cultivators have received as much as £ 35 to £ 45 per acre for this purpose, half of which

(1) See International Review of Agricultural Economics, Jan. 1916, pp. 47-56.

contributed by the local government and half by the central government. Swiss wines are protected by an import duty on all foreign wines.

VI. — Forests in the canton of Vaud are classified as follows:

Public and private forests. — Under the heading of private forests would also be included land owned by an association of small holders.

Protective and non-protective-forests. — Protective forests are those situated in the collecting areas of torrents or those which by their position exert a protective influence against storms, avalanches, rock-slides, landslips and erosions or which tend to regulate the flow of water from a mountain side.

Mountain forests and lowland forests. — The distinction between these two classes is merely an arbitrary division made locally by the communes at an altitude of 2500 to 3000 ft., and is not recognised in federal laws.

In every kind of forest whenever felling is in progress the replanting of a surface equal in area to the surface felled is made compulsory both by the federal and canton law. All trees to be felled must be previously arched and no clear felling is allowed without special permission from the local authorities. In the case of protective forests the Federal Government only can give leave for cutting and all operations must be carried out under the supervision of the local officer.

VII. — Various attempts dating as far back as the sixteenth and eighteenth centuries have been made to extend the area of orchards in the high parts of the canton of Vaud. In 1890 the Agricultural Institute at Ausanne imported a number of hardy varieties of plums, apples, pears and cherries from Russia, Sweden and Denmark, and nurseries were established at high altitudes (2500 to 4000 ft.) for their propagation. The following year a few small trial orchards were planted on Mount Jorat overlooking Lake Lehman at about 3000 ft. and when these were well started general planting was encouraged by means of practical demonstrations, lectures and by the free distribution of the new varieties.

The most successful kinds are given below:

Apples		Pears	Plums
Astakan	Borowinka	A variety imported under the name of	Rothdalmasiner.
Die Astrakan	Antonovka	Vinense Siouxona	
Li Naliv	Papierovka	proved to be beurré de Montécat.	
orka or Tulská			

There are now flourishing orchards of Titovka, Antonovka and Pavlovka at about 4000 ft. high.

9. — **The Oxygen Consuming Powers of Natural Waters.** — HEISE G. W., and AGUILAR R. H., in *The Philippine Journal of Science*, Vol. XI, Sec. A., No. 1, pp. 37-47. Manila, January 1916.

The oxygen consuming capacity of water as measured by its ability to reduce potassium permanganate is a sensitive means of detecting fluctuations in quality in a water supply, and gives comparable results when

a fixed method is strictly adhered to. In order to study some of the factors which influence the reaction a series of tests were carried out with river water drawn from the Manilla city reservoir and containing less than 5 parts per million of chlorides.

The first factor studied was the length of time allowed for the digestion. Samples of 200 cc were used and the tests were carried out at 100°C. The results are given in Table I.

TABLE I. — Reduction of potassium permanganate by water; effect of varying the duration of digestion.

Duration of digestion	Permanganate required (1)
	cc.
Less than 1 minute	0.82
15 "	1.10
30 "	1.27
45 "	1.29
1 hour	1.34
2 "	1.75
4 "	2.46

(1) 1 cc = 0.1 mgm oxygen.

The decomposition showed no signs of reaching an end point after several hours digestion. The tests were then repeated at lower temperatures, but even at 10° C. the effect of the time factor was still marked although the difference between the four and eight hour digestion was negligible for practical purposes.

The effect of the presence of chlorides was next investigated. Samples of 100 cc were used this time and the digestions were kept going for 4 hours at 30° C. Some of the results are given in Table II.

TABLE II. — Reduction of potassium permanganate by water; effect of presence of chlorides.

Chlorine content (in parts per million parts water)	Permanganate required	Difference in permanganate required due to presence of chlorides
		cc.
0	1.31	—
5	1.38	0.07
10	1.46	0.15
20	1.48	0.17

The error due to the presence of chlorides persisted even when digestion was carried on at a moderate temperature. This error was reduced, although not eliminated, if digestion was carried out at or below room temperature and if the final titration of excess potassium permanganate was made with sodium thiosulphate in the presence of potassium iodide and starch indicator. It was further reduced by digesting the water samples with potassium permanganate in alkaline instead of acid solution according to the method described by SCHULZE, and WINKLER (1).

A last series of tests was undertaken to determine the effect, if any, of the presence of traces of hypochlorite in the water. It was found that hypochlorites oxidize organic matter in cold or hot solution and should therefore be eliminated before any determination of the oxygen consuming power is made.

From these results it is evident that the determination of oxygen consumption is not at best an accurate measure of the organic content of water and it gives such uncertain results that isolated determinations are of very little value. It is only when a water supply is to be consumed repeatedly that the method becomes very useful.

(1) - **Immunity to Cow Pox as a Result of Intravascular Injections.** — CAMUS L., in *Comptes Rendus des Séances de l'Academie des Sciences*, Vol. 163, No. 14, pp. 338-340. Paris, October 2, 1916.

A series of experiments were carried out with cow pox vaccines in order to determine the length of time, if any, which must elapse between inoculation and immunisation. A very pure vaccine was injected into the veins or arteries of rabbits, and immunity was tested by local reactions. The results show that the time required for immunisation varies inversely with the amount of vaccine injected, so that though it may not be possible to suppress completely the latent or incubation period, it is easy to modify its duration. Individual differences in the subjects are less important than the amount of vaccine used. Other investigators (BOCSQUET, HUSSON, HEIM and GREGORY) who have not taken into account either the activity of their vaccine, or the size of their doses have obtained very contradictory results with regard to the period of incubation, and the above experiments offer a satisfactory explanation of the discrepancies recorded.

(2) - **The Royal Institute for Agricultural Experiments Tripoli.** — MANGANO G., in *Ministero delle Colonie, Ufficio Economico, Bollettino di Informazioni*, Year V, Nos. 1, 2 and 3, pp. 7-122. Rome, January, February and March 1916.

One of the first duties of the Agricultural Department ("Ufficio agrario") of Tripoli has been to found an experimental station for the improvement of existing agricultural practice in the colony and to extend the area of cultivated land. The station was established in the autumn 1914 at Sidi el Mesri, on the outskirts of the city of Tripoli, where build-

EXPERIMENTAL
AND
ANALYTICAL
WORK

(1) *Sz. Düsseld. polytech. Journal* (1868) 188, 197; *Zeitschrift für analytische Chemie* (1914) 56 (Ed.).

ings had been already erected for an agricultural school by the Turks. Temporary accommodation is there provided for a meteorological observatory, a museum and library, chemical and botanical laboratories, and for the necessary scientific and administrative staff. Store rooms, stables, implement sheds, cattle sheds and cottages for the servants and workmen are grouped round the main buildings; also a good covered well fitted with an electric pump and a reservoir of 2000 gallons capacity.

The experimental ground is divided into:

1) A *park* where varieties of trees and shrubs are tested for sylvicultural, ornamental and protective purposes. Thirty eight kinds are at present on trial and this number will be greatly increased as time goes on.

2) A *dry orchard* for fruits which are likely to prosper without irrigation. These consists of:

Peaches	Apricots
Walnuts	Almonds
Figs	Quinces
Loquats	Pears
<i>Zizyphus</i> spp.	Cherries
Pomegranates	Table olives
Carobs	Eucalyptus
Casuarina	

3) An *irrigated orchard* which is also provided with efficient wind screens. It is planted with all the fruits of the dry orchard except carobs, casuarina, olives, and eucalyptus, and has in addition:

Lemons	" Kin Kans "
Bergamots	Kumquats
Limes	Citrons
Oranges	Custard apples
Tangerines	Avocados

4) A *dry almond orchard* to test the possibility of establishing such trees on the dry steppe.

5) A *dry olive grove* consisting partly of an old established plantation and partly of a new plantation of native and Italian varieties.

6) An *irrigated palm grove* in which all the varieties of North African dates are eventually to be collected for purposes of classification. At present 47 kinds of *Phoenix dactylifera* are growing there. These have been all obtained from the coastal region between Agilat and Tadoura, and later, other parts of North Africa will be explored to provide new material for study.

7) A *dry vineyard* for testing species and varieties of Italian grape suitable for use as table fruit or as dried fruit. The climate of Tripoli should be well adapted to the production of the earlier varieties of sweet grapes.

8) A *plantation of prickly pears* on particularly arid soil when

unian, Sicilian and American varieties of the two types of plants will be raised — the spineless type as a fodder plant and the spiny kind for digging.

9) *A field for cereals* which at present consist of a few obscure varieties of local barley and some native and Italian varieties of wheat.

10) *A field for fodder plants* where hairy and common vetches, ichling (*Lathyrus sativus*), fenugreek, sulla or Spanish sanfoin, chloris, 1 taff are being tried without irrigation. A small plot of mangels is under experiment.

11) *A field for irrigated crops* which is principally occupied by maize, the rest being under tobacco. Of the latter the Turkish varieties from Herzegovina, Porsucian, Xanthi jaka, Aya Sluk and Samsoun, Virginia bright and Java have been under trial and these not only Sidi el Mesri, but also on various other estates.

As the coastal region has proved well adapted to the growth of mulberry trees, the question of introducing the rearing of silkworms on the farms is full of interesting possibilities. As a start a few experiments have been carried out with graine of the Pyrenees, Grand Sasso, jaune, Istria Yellow and native Yellow C and F breeds, and the sses Chinois or \times Bijaune and Bijaune or \times Batoum Yellow. The results have been most encouraging.

So far as irrigation problems are concerned, the Institute is at present investigating wells and water lifting apparatus for use on the different kinds of farms. In the immediate district of Sidi el Mesri two wells have already been dug and three others have been deepened and put into working order. But progress in the establishment of water raising plant is slower as the systems in use are numerous and varied and the individual merits of each have to be determined. Those at present under construction are :

- The Arab system of counterpoise or shaduf.
- The noria or endless chain with buckets, worked by horse gear.
- The windmill with force pump.
- The Archimedean screw worked by motor.
- The compressed air pump.
- Electric pumps of high and moderate power.

The Institute also proposes to take up the difficult problem of reclaiming the sand dunes, both with a view to extending the area of productive land and of protecting the more inland tracts from blown sand. An experimental ground has already been set aside for testing the various plants and trees which are known to have a binding effect on the surface and at the same time may be made to produce useful crops.

The department dealing with live stock has not yet been created, but eventually undertake research on : the native breeds of all classes of animals (including horses, cattle, dromadaries, camels, donkeys, goats, pigs, ostriches, and poultry) and the possibility of improvement by selection and by crossing with suitable imported breeds ;

the harvesting, storage and feeding value of forage crops ; the common diseases of live stock and means of checking and preventing them ; system of management and breeding and the returns to be obtained from each. The Institute itself will endeavour to keep a large head of all kinds of breeding stock to be drawn upon by other parts of the colony as required ; also demonstration flocks and herds to be run on economic lines. Extensive trials will be carried out at one of the special farms mentioned below on the management of animals turned to pasture.

A nursery has been established within two miles of Sidi el Mesri to provide stock for the Institute and for distribution to sub-stations and to native and Italian farmers. Olive trees (of the Tripoli, Tunisian and wild varieties), Seville oranges, bitter almonds and various forest trees are already being cultivated as well as certain fruit trees and bushes. Plots are also prepared for raising special strains of lucerne and tobacco.

The complete project of the Tripoli Institute includes the creation of two demonstration farms. One of these, in the region of Tarhouna, will specialise in the production of cereals and the grazing of live stock. The other, which has already made a start, is situated at Sabrata (district of Agilat) in the middle of a large area of good steppe soil, with a reasonably high water table. This area is crossed by the railway and enjoys a good climate so that the conditions are eminently adapted to the foundation of a big Italian farming colony. The type of farming proposed is one consisting chiefly of irrigated plantations, though the proximity of the water to the surface makes it possible not to exclude irrigated crops. Further, the settlement will afford a good opportunity of testing a system of land tenure which is very suitable to North Africa and may lead to the planting up of much land which is at present only producing the poorest pasture and an occasional barley crop. By this system, which is known as the "mougharsa", the landlord leases the land to the tenant for a number of years (usually ten), and during that time the tenant pays no rent, but is obliged to do a certain definite amount of planting to build a house and to dig a well. At the end of the given period, the whole property is divided up equally between the landlord and the tenant. At Sabrata, the obligations of the tenant will consist in the formation of an olive grove, the planting of almonds and other fruit trees — unirrigated — and the making of a small irrigated garden and orchard, where the tenant can grow a large part of his own food.

The establishment of a government experimental farm for irrigated crops has had to be postponed owing to the present scarcity of labour, but there are a number of Italians and natives already running their own irrigated farms and these will serve to guide intending settlers who wish to learn something about possible returns from irrigated crops.

1162 - Recent Investigations at the Imperial Institute, London : Whales' Bones from the Falkland Island ; Naked Barley from Cyprus ; Edible Beans from Burmah ; Paper-Making Materials from South Africa ; African Silk. — *Bulletin of the Imperial Institute*, Vol. XIV, No. 2, pp. 149-181 and 261-267. London, April-June 1916.

Whales' bones from the Falkland Islands. — The whaling industry of the Falkland Islands and its Dependencies (South Shetlands, Graham's Land, South Orkneys and South Georgia) is now the most important in the world. In the 1913-1914 season 9429 whales were caught, the total value of the products being £1 301 548. The bones, which accumulate in enormous quantities, were formerly thrown away, but are now boiled down with the flesh to extract the oil, and the residue is converted into manure. In the 1913-1914 season, 1327 bags of bone meal valued at £570 were produced in South Georgia, while the entire Colony and its Dependencies in the same year produced 94 835 bags of whale guano valued at £47 887. An average sample of the bones reduced to a meal was analysed at the Imperial Institute with the following results which are shown in comparison with those recorded for commercial raw bone meal :

	Whales' bone meal — Per cent.	Raw meal — Per cent.
Moisture	7.30	8.80
Organic matter	40.40	34.94
containing nitrogen	3.87	4.19
" oil	11.50	about 10
Phosphoric acid	20.24	21.66
Lime	24.06	28.53
Magnesia etc.	7.39	4.62
Siliceous matter	0.61	1.45

Naked Barley from Cyprus. — In a sample of skinless barley received from Cyprus, the grains varied in size, were of a light brown colour and had a dull translucent appearance. Their germinating power was 96 per cent within 5 days. The barley was analysed and compared with English and Azof varieties with the results given in Table I.

This naked barley could not be employed for malting purposes but possibly might be used by distillers. Also it ranked as a good class of feeding barley and might be employed for blending with other feeding stuffs. In March 1916 it was valued at from £2 10s to £2 12s 6d per cwt. London.

Edible beans from Burmah (1). — Experiments have been carried out at Mandalay, Burmah on the cultivation of Lima beans (*Phaseolus lunatus*) which were introduced from Madagascar and California in 1912-1913 and tepary beans (*P. acutifolius*) which were introduced from the United States in 1914-1915. The first crop of Madagascar Lima beans contained more prussic acid than the original seeds (0.0925 to 0.008 as against 0.002

(1) See R. 1916, No. 5.

TABLE I. — Composition of naked barley from Cyprus.

	Naked barley	English barley	Azot barley
	Per cent	Per cent	Per cent
Moisture	10.4	14.9	12.9
Total nitrogenous substances	11.5	8.0	12.3
True proteins	10.3	—	—
Other nit. subs.	1.2	—	—
Fat	1.9	1.5	2.5
Carbohydrates	72.4	68.5	65.1
Fibre	1.8	4.5	4.4
Ash	2.0	2.6	2.8
Albuminoid ratio	1:6.7	1:9.0	1:5.7
Food units	106	92	102

TABLE II. — Composition of tepary beans, of *Voandzeia subterranea* beans and of the residual meal from water-melon seeds.

	Tepary beans	<i>V. subterranea</i> beans	Residual meal from water-melon seeds
	Per cent	Per cent	Per cent
Moisture	12.0	8.25	9.5
Total nitrogenous substances	23.6	21.3	18.3
True proteins	20.6	19.8	17.5
Other nit. sub.	3.0	1.5	1.0
Fat	1.8	5.9	0.5
Carbohydrates	57.2	58.1	26.9
Fibre	2.7	3.2	41.9
Ash	3.2	3.3	2.9
Albuminoid ratio	1:2.9	1:3.4	1:1.5
Food units	119	127	74

to 0.0025); in subsequent crops this high content was considerably reduced though it still remained above that of the imported beans. It would appear from the results obtained that the prussic acid content is affected by the weather conditions, but not, on the other hand, by the nature of the soil on which the crop is grown. The Californian Lima beans yielded seed smaller than the original sample and containing 0.0045 per cent of prussic acid.

TABLE III. — *Chemical examination of tamboekie grass from the Transvaal and papyrus from Zululand.*

	Tamboekie grass	Papyrus	
		Stems and leaves	Stems only
		Per cent	Per cent
moisture (on drying at 100°-110°C)	10.2	12.1	11.6
1 (expressed on dry material)	7.4	6.0	9.4
Moisture of unbleached pulp (dried at 100°-110°C)			
Expressed on air-dry material	37.1	21.2	22.5
> material dried at 100°-110°C	41.3	24.0	25.5
Loss in weight of pulp on bleaching	3.1	13.9	4.9
Moisture of bleached pulp (dried at 100°-110°C) expressed on original material dried at 100°-110°C	40.0	20.7	24.3
Length of ultimate fibres	ins.	ins.	ins.
Mean Length	0.012 to 0.188	0.009 to 0.18	0.01 to 0.18
	0.081	0.042	0.048

i. They were valued at £12 to £14 per ton on a normal London market.

Tepary beans are said to be specially adapted to dry situations where other beans do not succeed, as they will bloom and set seed during periods of extreme heat, yielding a crop about four times as large as would be obtained from the kidney bean (*P. vulgaris*). The sample received from Mah was in good condition; it contained no alkaloids or cyanogenetic glucosides and compared favourably with haricot beans with regard to their value (Table II). On a normal London market it should be worth a ton.

Voandzeia subterranea beans from the Sudan. — *V. subterranea* is a leguminous plant widely cultivated in tropical Africa for its seeds which are an article of native diet. Specimens of the beans from the Northern Provinces, Nigeria and from Zanzibar were examined at the Imperial Institute some years ago (1); the present samples were of rather better quality. Their composition is given in Table II. They contain no cyanogenetic glucosides or alkaloids and could be used for making condiments at a price of about £4 per ton.

Water-melon seeds from the Sudan. — Water melons (*Citrullus vulgaris*) are cultivated on a considerable scale in Kordofan Province and a sample of the seeds was sent for examination to the Imperial Institute with a view to finding a market for them in London. The seeds contained

1) See *B. M. J.* Nos. 1 and 5.

7.4 per cent of moisture and yielded 23.6 per cent of brownish yellow oil which had the following constants:

Specific gravity at 15°C	0.923
Solidifying point of fatty acids	30.5°C
Acid value (mgms. potash per 1 gm. oil)	8.4
Saponification value	191.4
Iodine value	117.1 per cent
Hehner value.	95.1

The oil is very similar to that obtained from other cucurbitaceous seed. The residual meal left after extraction contains no alkaloids or cyanogenic glucosides; it has a high percentage of fibre and a low food value (Table II).

Colocynth pulp from the Sudan. — Colocynth is the name given to the peeled dried fruits of *Citrullus Colocynthis*, the material freed from seeds constituting the drug known in the British Pharmacopoeia as colocynth pulp. Before the war, it was largely obtained from Turkey & Austria and recently considerable quantities have been exported from the Sudan. The sample under examination was of good quality and was valued at 1s 3 d per lb.

Papermaking materials from South Africa. — Tambookie or tankie grass (*Cymbopogon Nardus* var. *vallidus*) is said to grow luxuriant over large tracts of country in the Transvaal reaching a maximum height of 5 ft. 6 in. The results of the chemical examination of the grass shown in Table III. A high yield of pulp of good quality and easily bleached was obtained, and from it a strong paper was prepared. The grass was valued at £4 per ton.

A sample of papyrus from Zululand consisted of greenish yellow pithy stems averaging 7 ft in length and 1 in. in diameter at the base, each with a tuft of narrow pointed leaves (about 14 ins. long) at the top. The proportion of stems to leaves in the sample was as 4 to 1. Results of the chemical examination are given in Table III. The yields of pulp are comparatively low, but the material might be used with profit if worked up near its place of production.

African wild silk. — The only African insects which produce silk in important quantities are those belonging to the different species of *Anaphe* (fam. *Eupterodidae*). The most important of these found on British territory are:

- A. infracta* in Nigeria and Uganda
- A. venata* in Nigeria and the Gold Coast
- A. moloneyi* in Nigeria
- A. ambrizia* in Uganda
- A. panda* in Natal
- A. reticulata* in Natal.

All these insects form silken nests or colonies within which each weaves its own cocoon. The nests vary considerably in size and form.

they may be more or less spherical as in *A. infracta* and *A. venata* or flattened as in *A. moloneyi*. The envelope of the spherical forms usually consists of three thicknesses of silk: the outer layer more or less papery in texture; the middle layer, composed of loosely spun silk arranged in a number of superimposed sheets; the innermost layer, hard and parchment-like. The envelope of the flattened colonies is made up of a single layer of closely interlaced silk. The silk of both nests and cocoons is naturally brown in colour, but in the absence of light the worms produce a white silk, and for this reason the natives in parts of Nigeria sometimes enclose them in calabashes.

Anaphe silk cannot be reeled as is done in the case of silk from *Bombyx mori*, and it is therefore carded and spun as "waste" silk; but apart from this it more closely resembles *B. mori* silk than does any other kind. It takes dyes well and has been found useful for the manufacture of velvet, wing silks and other materials. The degummed silk has been valued about 1s per lb but owing to the large amount of labour required to clean the silk from extraneous matter, the crude material if shipped to the United Kingdom would only realize about 1d or 2d per lb. If however, the silk were cleaned locally by the natives, the clean product might be worth 6d per lb. in London.

It has been shown experimentally in Uganda that the worms can be successfully domesticated and there seems to be no reason why a new industry should not be established in Africa.

CROPS AND CULTIVATION.

3-Cause and Nature of Soil Acidity with special Regard to Colloids and Adsorption.

—TRUOG E., in *Journal für Physikalische Chemie*, Vol. XX, pp. 457-484 1916; abstract in *Journal of the Society of Chemical Industry*, Vol. XXXV No. 15, pp. 853-856. London, August 15, 1916.

The production of acidity or alkalinity when certain neutral solutions come into contact with certain solids is probably due to chemical action rather than to selective adsorption of ions. Cameron's contention that the reaction towards litmus of washed absorbent cotton (and inferentially of certain soils) is due to the adsorption of cations, is untenable, as such cotton has been found to contain an insoluble fatty acid (possibly margaric acid), which would not be completely removed by the washing with alkali and acid. When cotton is brought into a neutral salt solution, the salt reacts with the fatty acid, some cations are removed and an equivalent amount of soluble acid liberated. Similarly, the reduced selective adsorption of ions by charcoal is accounted for by chemical actions between impurities contained in it and the dissolved salt. Assuming selective adsorption, the vastly greater adsorptive power of soils would still need explanation. Arguments are also adduced to prove that soil acidity is not the result of selective ion-adsorption, by acids or by finely divided solids; and it is shown experimentally that

under suitable conditions, the reactions causing soil acidity proceed according to chemical laws. The acidity in well aerated soils, in particular in cultivated upland soils, is due to the hydrolysis of silicates, of which the bases are removed by plants and by soil water, and to the silica and acid silicates left behind. The weathering process in soils can be reproduced by treating powdered basalt, granite felspar, etc., with carbonated water and filtering: the residues are acid to litmus. In dry regions the soluble salts accumulate and cause alkalinity. In these soils organic acids derived from plant residues are of little importance: they may be formed, but are quickly transformed. In badly aerated soils e.g. in peat soils, the plant remains are decomposed much more slowly; instead of being oxidised to carbon dioxide, much of the carbon remains in the soil in organic combination as the so-called humus acids, and eventually transformed into coal.

The latent acidity of a soil may be largely due to kaolinite and mica compounds, or to free quartz; and the results of the determinations of active and latent acidity show that the amounts of different hydroxides that react with the insoluble acids, are approximately chemically equivalent. The fact that acid soils do not take up equivalent amounts of different bases from salt solutions possessing a common ion, is opposed to the hypothesis that soil acidity is due to the presence of free acids, for the reactions involved would be much influenced by secondary reactions. By using small quantities of finely powdered soil and large volumes of salt solutions, and minimising the time of contact, the effect of such side reactions can be practically annulled; and determinations of soil acidity under these conditions give results which are best explained on the assumption of the existence of free acids. Further, the adsorption hypothesis would lead to the conclusion that the acidity of a soil would increase if the particles were ground to an impalpable powder; experiments showed a slight decrease.

NING UP
ND FOR
TIVATION

1164 — The Reclamation of Arid Steppe Soil and of Shifting Sands in the Province of Astrakan, Russia.

— VYSOTZKIF G., The flora of Ergenia and the conditions under which it is developed. *Труды Бюро по практической Ботанике* (Bulletin of Applied Botany), Year VIII, Nos. 10-11, pp. 1113-1418. Petrograd, October-November 1915. — II. Part J. G., The shifting sands of the province of Astrakan. *Сельское Хозяйство и Аграрное водство* (Agriculture and Sylviculture), Vol. CCC, pp. 616-639. Petrograd, April 1916.

Geographical conditions. — In Russia there are three distinct regions of arid steppes:

- 1) The Pontic region around the northern margin of the Black Sea.
- 2) The Transdon region and that of the northern Caucasus which together form a triangle with apices at Novotcherkassk, Tzarytai and Mozdok.
- 3) The Transvolga region also in the form of a triangle with apices at Kamichin, Saratov and Uralsk.

The last two regions are situated on the edge of a vast semi-desert area which surrounds the Caspian Sea and occupies the greater part

the province of Astrakan or nearly 11 million acres. This province is divided into two almost equal parts by the lower Volga; the western half occupied almost entirely by the Kalmuks steppe, and the eastern side which forms the Kirghiz steppe. On the western boundary is the Plateau of Ergenia which constitutes the watershed between the basins of the Don and the Volga and separates the Transdon steppe from the Kalmuks. The north of the Kalmuks steppe and the whole of the Transdon steppe (which covers an area of some 5½ million acres) are almost completely free from shifting sand. Travelling south through the Kalmuks steppe, patches of loose sand become more frequent and larger till finally they form a continuous surface which also extends up the right bank of the Volga.

To the east of the Volga between the northern boundary of Astrakan and Khanskaia Stavka the soil is only occasionally loose and shifting, but south and east of that district begins a vast sandy tract which gradually merges into a true desert, where there is not a sign of vegetation and where the surface has been blown up into dunes which are continually being remodelled by the wind. This sandy tract of eastern Astrakan extends over about nine and half million acres and makes up 88 per cent of the total desert steppe in the eastern provinces of Russia.

Geological conditions. — The whole of Astrakan including Ergenia has a common geological origin, *i. e.* black, compact, impermeable clays of the lower tertiary which hold up the underground water. In the Ergenia area these are covered by oligocene sandstones readily disintegrated and overlaid by clays and loams whose derivation is still obscure and which gradually pass into loess at the surface.

In the main Astrakan plain, which was once the bed of the Aral-Aspian Sea, the changes in sea level have destroyed the sandstones and these have been replaced by a series of deposits which are sandy at the base and clay above. The most important of these sediments is a dark grey clay which often comes to the surface in ravines and gives rise to agricultural soil. It varies in thickness from 2½ to 23 feet, is plastic and heavily charged with mineral salts (gypsum, sulphate of soda and boronates). Above the clay are two more recent deposits, *i. e.* a thin layer of grey sand covered by an aeolian deposit of yellow sand.

The actual surface of the steppe at present is one vast expanse of loose sands, the products of the disintegration of the very friable uppermost layers. As these layers for the most part only vary in thickness from 2 to 10 inches, they could not possibly supply alone the enormous quantities of sand on the Astrakan plain. The remainder is derived from adjoining depressions in which cyclones sweep with such force that the spian clays have been laid bare in places.

The Astrakan sands consist of well rounded grains, yellow in colour owing to the presence of oxides of iron, and very fine (0.1 to 0.2 mm in diameter). The smoothness of the grains gives the sand a very unstable character with no power to resist the force of the wind which piles them into shifting dunes.

Meteorological conditions. — The climatic of Astrakan is continental. Winters are extremely severe and last three months, a minimum temperature of — 30° C being occasionally reached. Then a very short spring is followed by great summer heat when the thermometer often rises to 40° C. Prevailing winds are from the east and come like a hot blast across the country. The rainfall is very low. At Astrakan it only amounts to 5.72 ins. while the evaporation is 29.3 ins. or five times as great; there are 121 rainy days per annum with dry intervals which usually last 7 to 10 days except in July and August when there may be 50 or more consecutive dry days, and on the edge of the Kirghiz steppe drought lasting 130 days has been recorded. In Ergenia the rainfall is higher, 4.5 to 9.5 ins. per annum. Mean temperatures in the desert region (Astrakan) and in Ergenia (Tzaritzin) are as follows:

	Astrakan C	Tzaritzin C
Mean temperature for January	7.2	11.3
" " " July	25.5	29.6
Mean annual temperature	9.4	7.9

Underground water. — As a result of numerous investigations it has been proved that there are two layers of underground water in Astrakan, a lower one 25 to 30 feet below the surface, heavily charged with salts, and an upper of fresh water close to the surface and found in the regions where the ground is covered with *Artemesia*. A well 13 feet deep and 5 feet wide in such regions will supply enough water for 100 head of cattle throughout the whole summer.

I. *Ecological study of Ergenia.* — A certain amount of planting was carried out in Ergenia about the middle of the last century. In 1913 the Russian Department of Forests wishing to know whether it would be advisable to resume planting operations, instituted an enquiry into the progress of the planted areas. The writer who was put in charge of the enquiry did not limit his observations to the condition of the forests, but at the same time made a thorough study of the entire regional flora in its relationship to soil, to climate and to cultivation. In the present paper he gives a detailed ecological description of the region, using for the purpose not only his own data, but also that collected by other investigators. Afterwards he discusses the agricultural possibilities of the area.

In studying the plant associations the system was followed of giving to each association a descriptive name which indicates the type of flora represented. For instance :

Poetum means a multifloral herbaceous flora in which *Poa pratensis* is dominant.

Stipetum (from stipare = to crowd) denotes a typical flora of the virgin steppe forming close turf and made up chiefly of species like *Stipa* and *Koeleria* and in the east *Arenaria desertorum* Less.

Thymetum is the flora of the calcareous hills where the aromatic species predominate, especially *Thymus*, *Satureja*, *Hysopus*, *Zizyphora*, *Salvia*, *Scutellaria*, *Stachys*, *Lavandula*.

Artemisiectum is the flora of the acid steppes with weak alkali soils, the dominant species being *Artemisia maritima* and its numerous varieties, *Artemisia pauciflora* Keller, etc.

Salsolectum is the flora of strong alkali soils dominated by *Salsola*, *Salicornia*, *Suaeda*, *etrosimonia*, *Brachylepsis*, *Kalidium*, *Camphorosma*, *Tamarix*, etc.

Using this type of nomenclature, the chief plant associations in Russia are:

Forest trees	Herbaceous plants and mosses
Saliceta	Sphagneta
(Alneta, populeta)	Carecta
(Betuleta, especially in the east)	Poareta
Abiegena	Stipeta
Pineta	(Thymeta?)
Querceta	Artemisieta
(Fageta)	Salsoleta

On the virgin steppe of the Ergenian Plateau, the dominant plant association is divided into three groups according to the soil: 1) *stipetum villosum* on the black soil; 2) *stipetum cinereum* on the light brown soils; and 3) *stipetum gramineum* on the dark loams. The last is the most abundant and its flora is given below.

BOTANICAL COMPOSITION OF THE STIPETUM GRAMINEUM.

A. -- DOMINANT SPECIES.

I. WOODY PLANTS.

Calophaea wolgarica, (Spiraea hypericifolia).

II. PLANTS WITH LONG RHIZOMES.

<i>Pyrum ramosum</i> .	<i>Carex stenophylla</i> C.	<i>Achillea setacea</i> .
<i>cida vulgaris</i> .	<i>Inula Oculis Christi</i> C.	<i>Glycyrrhiza glabra?</i>
<i>option Picea?</i>	<i>Ranunculus oxyspermus</i> .	<i>Poa setacea</i> .

III. PLANTS WITH SHORT RHIZOMES.

<i>Pyrum cristatum</i> C.	<i>Allium flavescens</i> .	<i>Gallium verum</i> V, C.
<i>rm lineare</i> .	<i>(Bromus erectus)</i> .	<i>Inula hirta</i> .
<i>syris villosa</i> C.	<i>(Helichrysum arenarium</i> V).	<i>(Ranunculus foersteri?)</i>
<i>ethrum achilleifo-</i> <i>rm</i> C.	<i>Iris pumila</i> C.	<i>Valeriana tuberosa</i> , C.
		<i>Veronica prostrata</i> .

IV. PLANTS WITH SHORT RHIZOMES AND SHORT INTERNODES.

<i>Sarcocapna</i> ,	<i>Koeleria gracilis</i> C.	<i>(Phleum Beckmanni)</i> .
	<i>Festuca sulcata</i> C.	<i>Stipa stenophylla</i> C.
	<i>Stipa capillata</i> C.	
	<i>Stipa Lessingiana</i> C.	

V. PLANTS WITH TAP-ROOTS.

<i>Achillea leptophylla.</i>	<i>Arenaria graminifolia.</i>	<i>Asperula glauca</i> (III?)
<i>Artemisia incana.</i>	<i>A. longijolia</i> C.	<i>Astragalus asper.</i>
<i>Artemisia pauciflora.</i>	<i>Astragalus subulatus.</i>	<i>Centauraea ruthenica</i>
<i>Asperula humifusa.</i>	<i>Astragalus utriger.</i>	<i>Crambe aspera.</i>
<i>Astragalus albicaulis.</i>	<i>Dianthus leptopetalus</i> C.	<i>Dianthus capitatus</i> C.
(<i>Astragalus phrynosomes</i>). (<i>Astragalus testiculatus</i> et A. <i>dolichophyllum</i>).	<i>Eryngium campestre</i> C.	<i>Gypsophila paniculata</i> C.
<i>Cachrys odontalgica</i> (C.).	<i>Euphorbia Gerardiana</i> , VI, C.	<i>Medicago falcata</i> C.
<i>Dianthus rigidus.</i>	<i>Helichrysum arenarium.</i>	<i>Médicago versicolor.</i>
D. <i>pallidiflorus.</i>	<i>Herniaria incana.</i>	<i>Phlomis pungens</i> C.
<i>Eriophyllum longijolia.</i>	<i>Linum austriacum.</i>	<i>Salvia memorosa</i> . (= S. stibestrise).
<i>Terula caspica</i> C.	<i>Marrubium praecox.</i>	<i>Silene wolgensis.</i>
<i>Kochia prostrata</i> C.	<i>Potentilla astracanica.</i>	<i>Sisymbrium juncinum</i> C.
<i>Statice incana</i> C.	<i>Statice latifolia</i> C.	(<i>Taraxacum serotinum</i>).
<i>Statice sareptana</i> et St. tomentella VI, C.	<i>Thesium ramosum.</i>	<i>Thymus Marschallianus</i> C.
<i>Veronica orientalis.</i>	<i>Veronica spicata</i> III.	<i>Verbascum phoeniceum</i> C.
		<i>Veronica austriaca.</i>

VI. PLANTS WHICH PROPAGATE THEMSELVES BY SECONDARY ROOTS.

(<i>Convolvulus lineatus</i>).	<i>Jurinea linearifolia</i> C.	<i>Artemisia austriaca</i> C.
		<i>Euphorbia leptocaula</i> C. (<i>Lepidium Draba</i>).

VII. BULBOUS AND TUBEROUS PLANTS.

<i>Allium moschatum.</i>	<i>Tulipa Schrenkii</i> C.	<i>(Allium paniculatum)</i> C.
(<i>Colechicum luteum</i>).	<i>Allium flavum</i> C.	<i>Ornithogalum tenuefolium</i> .
	(<i>Gagea bulbifera</i>).	<i>Ornithogalum brachystachys</i> C. (<i>Gagea pusilla</i> ?).

B.—SECONDARY SPECIES.

VIII. BIENNIALS.

<i>Trinia Hoffmanni</i> and its his- pida variety.	<i>Erysimum versicolor.</i>	<i>Carduus uncinatus</i> C.
	<i>Erysimum canescens</i>	(<i>Carduus hamulosus</i>).
	<i>Onosma tinctorum</i>	(<i>Falcaria Rivini</i>) C.
	<i>Salvia Achyropis</i> C.	<i>Silene viscosa.</i>
	<i>Serratura (xeranthemoides)</i> C.	<i>Verbascum orientale.</i>

IX. WINTER-SPRING, ANNUALS.

a) Early:

<i>Ceratostylis orthoceras</i> et <i>Veronica arvensis</i> et <i>V. verna</i> .	(<i>Draba verna</i> ?) C.
C. <i>falcatus</i> .	(<i>Thlaspi perfoliatum</i> ?)
<i>Androsace maxima.</i>	<i>Androsace elongata</i> C.
<i>Agropyrum prostratum</i> et A. orientale.	<i>Holosteum umbellatum.</i>
	<i>Alyssum minimum</i> C.

b) Late:

(<i>Chorispora tenella</i>), (<i>Colpodium humile</i> IV)	<i>Bromus tectorum.</i>	<i>Arenaria serpyllifolia</i> C.
	<i>Bromus squarrosum</i> C.	
	<i>Poa bulbosa vivipara</i> IV.	

X. WINTER ANNUALS.

<i>nicus linifolius).</i>	<i>Echinospermum patulum.</i>	<i>Camelina microcarpa.</i>
<i>nidum perfoliatum</i> C.	<i>(Filago avensis) C.</i>	<i>Crepis tectorum.</i>
<i>ophila muralis</i> C.	<i>(Trifolium arvense) C.</i>	<i>Echinospermum Lappa.</i>
<i>inospermum strictum.</i>	<i>Delphinium Consolida C.</i>	<i>Lithospermum arvense.</i>
		<i>Sisymbrium Sinapistrum C.</i>
		<i>(Sisymbrium Loeselii et S.</i>
		<i>Sophia) C.</i>

XI. SPRING ANNUALS.

<i>ratocarpus areuarinus.</i>	<i>Eragrostis minor C.</i>	<i>(Chenopodium album ?)</i>
<i>thiopisilon sedoides C.</i>	<i>Polygonum Bellardii C.</i>	<i>(Polycnemum arvense) C</i>
<i>abda tamarijina).</i>	<i>Atriplex patula.</i>	
<i>escina annua).</i>	<i>(Keranthemum annum).</i>	

XII. PARASITIC PHANEROGAMS.

<i>Cuscuta planiflora.</i>	<i>Orobanche coerulea.</i>
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C. — CRYPTOGAMS.

XIII. MOSES,	
<i>Tortula ruralis.</i>	<i>Grimmia.</i>

XIV. ALGAE AND LICHENS.

<i>nella vagans.</i>	<i>Nostoc commune.</i>
<i>aria aculeata.</i>	
<i>claria scruposa).</i>	

XV. FUNGI.

Probably the majority belong to the *Angiocarpineae* (*Lycoperdon* spp., *Geaster* spp.)
Plectohasidiniae (*Pisolithus* *herculeum* Fries).

In the above table the species are divided into three phytosocial groups according to their
 affinities. In the left hand column are placed those species which are more xerophytic than
 typical plants of the association and which are bordering on the next plant association i. e. *sili-*
tanionum. In an analogous way the species placed in the right hand column are all bordering
 on the more hydrophytic association i. e. *stipetum latifolium*.

The names of the commonest species are printed in heavy type. Brackets mean that the
 location of the species is not very certain. Roman numerals are used to show that the
 species they follow occupies an intermediate position between the class in which it is placed and
 that indicated by the Roman figures. The letter C is used after the name of a species when
 that species is a characteristic plant of the virgin steppe of Ascagna Nova (Pontic re-
 gion) which has been studied by J. K. PATZOSKI.

The dominant species all consist of perennial plants which occupy the soil in a more or
 less favorable condition, absorb more water and nutrient salts than any other species and are the
 true producers of organic matter. The secondary species on the other hand are all plants
 flower only once (annuals and biennials). In the *Ergenia stipetum romanicum* the
 first species are made up of 93 species or 67 per cent of the total number, while
 the secondary species, including parasite plants, are represented by 59 species only.

The deterioration of Steppes and the means taken to check it. — Sheep farming is general in the Ergenia region, and the system of grazing is such that it frequently has a deteriorating effect on the flora which tends to become more xerophytic in character and by its gradual modification influences the grazing value and the general productiveness of the virgin steppes. In order to prevent this deterioration and consequent decline of the livestock industry it is absolutely necessary that all grazing areas be given regular periods of rest during which the natural flora will have a chance of recovering from the effects of the grazing. Further, selected plots of the virgin steppes should be fenced round and protected from live stock in order to provide natural seed producing centres for the reconstitution of the surrounding flora. These plots should occur at frequent intervals and include various types of plant associations, *j. e. stipetum graminum*, *stipetum subsabulosum*, *stipetum cinereum*, *stipetum sabulosum*. It is also recommended that dry farming methods be tried with the idea of introducing a more intensive form of farming.

The creation of artificial forests on the arid steppes is one of the most interesting experiments in applied botany and has important bearings on ecological problems. On the Ergenian plateau woody plants will only prosper in places where the water table is accessible, such as for instance in deep hollows, in ravines, or at the foot of gentle slopes. As such places being very limited in extent, there is no possibility of establishing forestry as a separate industry. All attempts to do so by the Department of Forests have failed. The cultivation of trees will have to form part of the ordinary farming practice, and small plantations will be the rule. Both fruit and timber may be produced. The most suitable trees have proved to be: *Robina Pseudacacia*, *Quercus* spp., *Populus* spp., *Pyrus communis*, *Morus* spp.

II. — *The shifting sands of Astrakan* (1). — Ten million acres in the province of Astrakan are covered with shifting sands which have been formed during the nineteenth century and which are estimated to spread at the rate of 100 000 acres per annum. The principal cause of the rapid transformation of good pasture into barren sand is the bad management of the pastoral population who keep their flocks and herds so long in one place as to result in the complete destruction of the turf. Neither is the condition of affairs very much better where arable farming is practised, for the use of tillage implements helps to loosen the surface, while the cultivators manage to suck the land dry in a few years by a bad system of husbandry, taking one crop after another without manure; then as the crops began to fail, the sand invades the ruined fields and gradually covers considerable areas.

The damage done is enormous, not only in Astrakan, but also in the adjoining provinces and in the whole of southeastern Russia. In 1898 the Government became aware of the inroads of the scourge, but it

(1) A list of Government publications on the subject is given.

ken to check its progress. During the period 1904-1909, 46000 acres were brought under cultivation and in 1913 a special Government Service was organized to deal with the question. The province of Astrakan was put in charge of a chief forestry officer and divided into six districts in each of which a sub-officer was appointed to superintend the work of reclamation. The seven officers were university men and had a staff of 23 working foresters under their orders. All work was carried out and financed on one of the three following systems:

1) The State to supply all technical advice and the material for digging or planting, but all the labour to be provided by the landlord. Area dealt with annually: about 1300 acres.

2) The State to supply technical advice, and to pay half the expenses of the working foresters required to superintend the work, and make an allowance of 5d per day towards the housing and keep of each worker. The population to provide the men and to pay the other half the foresters' expenses. Area dealt with annually: 1300 to 2600 acres.

3) The land to be temporarily made over by the landlord to the Ministry of Agriculture. The State to do the planting and to pay 90 cent of the total expenses, the balance being paid by the Administration of the Kirghiz. Contracts of this kind were begun in 1908 and in 1913 some 1 300 000 acres has been planted.

Every year the forest officers make a report of the work done in their districts as well as recommendations for the further development of the scheme.

Methods employed for fixing the surface of shifting sands. — Experiments in Northern Astrakan have shown that *Salix acutifolia* Wild. can give an excellent binding effect on the surface of sands. Cuttings taken in the tips of the branches are merely placed in a plough furrow. The method is simple and inexpensive, costing about 6s per acre and at the end of three or four years not only is the capital expenditure repaid, but the land may have risen in value to the extent of another 6s per acre.

In the southern part of the province, where the sandy area is greatest, fixation is carried either by planting cuttings of *Salix acutifolia* and *S. bica* Pall (1) ("narym-tala") or young plants of *Pterocactus aphyllus* Pall (2) ("djuzguu") and *Calligonum* spp. (3) ("Kandym") or by sowing of herbaceous crops. The latter is the more common method, as sowing is comparatively expensive (£ 3 to £ 5 per acre), and require besides some sort of protection from the wind, such as parallel wind screens 9 ins. high and 13 ft. apart costing £ 1 10s to £ 3 per acre. Plantings too, require after cultivations in the form of hoeings and weedings. Herbaceous plants on the other hand are not only less costly to grow, but

1 According to VISOTSKI, in *Bulletin of Applied Botany* No. 10-11, 1915, p. 1240.

2 Cf. *Agricultural Encyclopaedia*, Vol. IX. p. 482. Petrograd 1905. Publishers, A. E. ZN.

3 Cf. Id. Vol. X, p. 143. Petrograd 1907.

cover the surface with crops which are of great and immediate value to the population.

Where the conformation of the land will allow it, surface vegetation will gradually appear if the soil is left quite undisturbed. *Elymus arenarius* and *Agriophyllum arenarium* are the first to establish themselves and their roots rapidly spread over the surface and down into the sand to a depth of even 5 or 6 yards. Later other species appear, gradually covering the surface and protecting the sand from the action of the wind. Then finally the two first comers disappear and their places are taken by *Artemisia maritima* which provides excellent sheep pasture. But to complete this process, 20 or 30 years are required and it is general more satisfactory to hasten matters by artificial methods, at least on some parts of the area, so that centres for seed distribution may be formed and help in the natural reclamation of the land. Usually the procedure is as follows: a survey is made of the area, to pick out places which are sheltered from the wind, such as the hollows of the dunes. Seed of *Elymus arenarius* and *Agriophyllum arenarium* is then sown in patches about one square yard on these selected spots and at the rate of 3 to 4 lbs. of each per acre. The crests and flanks of the dunes, where seedlings would at once be destroyed, are not touched.

All seeds are supplied from Government seed stations of which are already established and occupy 35 acres of land. Cuttings and young woody plants are also raised in Government nurseries. Those in the north of the province grow pines, birches, oaks, black poplar, etc., while those in the south produce robinia, apricots, *Pterococcus aphyllus* and *Calligonum* spp., the total area under nurseries being 150 acres.

Replanting is only just in its initial stages. In 9 years not more than 45 acres have been planted besides 3 gardens and 4 vineyards occupying about 11 acres. The real obstacle to progress in this direction is the uncertainty as to whether the greater part of the province of Astrakhan is adapted to the establishment of forests; but with the institution of the special State Service referred to above, the question will receive proper attention and in the event of a favourable report, planting will proceed more vigorously.

MANURES MANURING

1165 - Research on Superphosphates. — PRATOLONGO U., (Agricultural High School) in *Annali di Chimica applicata*, Vol. VI, Nos. 3 and 4, pp. 59-112. Rome, 1916.

The mechanical condition of superphosphates is a most important factor in estimating their value, as unless the manure be dry and in a very fine state of division it is impossible to spread it evenly on the land. In order to determine how the friability and dryness are affected by the conditions of its manufacture investigations were made on the constituents of the substance in the various stages of the process. The results summarised as follows:

1) Superphosphate contains three chief constituents, calcium phosphate, mono-and dicalcium phosphate, which are found in a more or less hydrated condition and under various crystalline forms. Calcium

phate may be present either as the anhydrous salt or as gypsum. In ordinary superphosphates the former predominates, usually almost exclusively; where however the superphosphate has been prepared from bones and with limited quantities of sulphuric acid, the calcium sulphate is then nearly all in the form of gypsum. Monocalcium phosphate is commonly $\text{CaH}_4(\text{PO}_4)_2 \cdot \text{H}_2\text{O}$, but the anhydrous salt is not rare and has a very definite effect on the character of the manure. The same applies to dicalcium phosphate.

2) Superphosphate also contains a certain amount of moisture, its so-called "liquid phase" which consists essentially of a solution of phosphoric acid and phosphate of lime, and which largely controls the mechanical condition of the manure.

3) The investigations in this connection have made it possible to define exactly what is meant by "true moisture" and "free phosphoric acid", terms which have been used somewhat loosely up to the present. An examination of the relationship between the chemical and physical properties of the superphosphate have shown that the state of division is intimately connected with the measure of its liquid phase and still more directly with its true moisture, or in other words, with the water present in a liquid form as distinct from water of crystallisation. Further the degree of fineness of the superphosphate also varies with the amount of free phosphoric acid in the fertilizer. Two methods are suggested for the determination of true moisture, both being based on the solubility of the free water in cold alcohol. This alcohol extract may also be used for estimating free phosphoric acid.

4) The investigation into the conditions of the manufacturing process as affecting the constitution of the product has shown that the state of hydration in which mono-and dicalcium phosphate are deposited and the content of free phosphoric acid in the fertilizer are regulated by the temperature curve of the reaction and by the dilution of the sulphuric acid employed. Both free phosphoric acid and true moisture (taken as the difference between total moisture and that retained as water of crystallisation) increase with the temperature. Other conditions being equal the free phosphoric acid content also varies with the strength of the sulphuric acid used.

5) In the industrial process, calcium sulphate is first deposited in the anhydrous form or rarely in the semi-hydrated form ($2\text{CaS}_4 \cdot \text{OH}_2\text{O}$); gypsum, when present, may be looked upon as a secondary product resulting from the hydration of the two above compounds. Mono and dicalcium phosphates on the other hand are deposited as anhydrous or hydrated salts according to the temperature and composition of the liquid in which they are formed, and these two related factors govern the mechanical condition of the resulting superphosphate.

Once the relationship has been established between the temperature curve of the reaction and the properties of the substance produced, it is easy to organize means of regulating the process by adjusting the heat of reagents, the quantity of acid used, the degree of fineness to which

the raw phosphate is ground, the size of the charge put into the mixer and the duration of the mixing, the aeration of the reaction chamber. With proper adjustment it is possible to convert the whole of the raw phosphate into soluble phosphate and to obtain in the finished product a very fine state of division.

In a general way the temperature of the mixture is kept between 60° and 100° C. Outside these limits, which vary slightly with the acidity, a perceptible increase of the liquid phase is brought about which exercises a marked influence not only on the state of subdivision of the immediate product, but also on its successive transformation. This may even confer definite hygroscopic properties to the mass and may completely prevent the secondary formation of gypsum at the expense of anhydrite which is a change conferring on the ultimate product a high degree of dryness and fine subdivision.

The experiments confirm the results of practical experience in manuring works, *i. e.* that in order to obtain a fine dry superphosphate the temperature in the mixer should not exceed 100° C.

1166 - Substitutes for Basic Slag in Italy. — MENOZZI A., in *Le Stazioni sperimentali italiane*, Vol. XLIX, No. 1, pp. 7-9. Modena, 1916.

Before the war, the annual consumption of basic slag in Italy surpassed 30 000 tons, the greater part of which came from abroad. Since August 1914, however, imports have almost ceased. Basic slag has always been recommended in preference to superphosphate on soils poor in lime and rich in organic matter, but on many such soils superphosphate has given excellent results. PRATOLONGO has recently shown by his work at the Milan Agricultural High School that such soils have a considerable power of absorption for phosphoric acid in the form monocalcium phosphate, *i. e.* in the form present in superphosphate. He showed further 1) that the phosphoric acid is very rapidly absorbed by hydrates of iron and aluminium so that there is no chance of its being washed away; and 2) that superphosphate, though an acid manure, can be added to the soil containing no lime without giving the soil an acid reaction. It is therefore evident that applications of superphosphate on non-calcareous land are not always followed by the ill-effects one might fear.

It is only when dealing with bogs or sour peats that superphosphate is really unsuitable and in these cases either bone meal may be used, or better superphosphate which has been on the Italian market for some time and whose output could easily be increased should the demand for it arise.

1167 - Iodine Content of Stassfurt Salts. — WINKLER L. W. in *Zeitschrift für anorganische Chemie*, Year XXIX, No. 71, pp. 342-343. Leipzig, September 5, 1916.

Hitherto determinations of iodine in Stassfurt salts have given discordant results. A series of very accurate analyses were therefore carried out on carnallite and sylvine. The method employed is fully described. Quantities of iodine found in the two minerals were as follows:

	mgms. of iodine per 1000 gms. of substance
Sylvine colourless, crystalline	0.0
" hyaline crystals	0.0
" colourless crystals	23.7
" crystalline light yellowish red.	13.7
" " yellowish red	73.1
" colourless crystals,	0.0
Carnallite crystalline yellowish	5.0
" " grey	4.5
" " red	0.0
" " pink	0.0
" colourless crystals	0.0

None of the samples analysed contained potassium iodate. In sylvine, the iodine was present as potassium iodine and in carnallite it was probably in the form of $KI \cdot MgI_2 \cdot 6H_2O$. Crude bromine was also tested for iodine, with negative results.

68 - Effect of Varying Amounts of Admixed Water upon the Decomposition of Crude Calcium Cyanamide and the Formation of Dicyanamide. -- HAGER G., and KERN J., in *Zeitschrift für angewandte Chemie*, Vol. XXIX, pp. 221-223, 1916; abstract in *Journal of the Society of Chemical Industry*, Vol. XXXV, No. 15, pp. 856-857. London, August 25, 1916.

Quantities of crude calcium cyanamide of 100 gms. each were treated separately with 5, 10, 15, 25, and 50 gms. of water and enclosed in air-tight glass vessels. After 5 or 7 months the material was analysed by CARO's method. The fertiliser used contained: total nitrogen 18.62 per cent, of which 17.73 was water soluble, cyanamide nitrogen 16.75 per cent, nitrogen as dicyanamide 0.50 per cent, as ammonia 0.24 per cent, and "urea" nitrogen (*i. e.* the element left in the filtrate after precipitation of the dicyanamide) 0.48 per cent.

Seven months storage without water caused no perceptible change: with 5 and 10 gms. of water, the changes were very small, the dicyanamide nitrogen rising to 0.61 and 0.87 per cent respectively. The presence of 15 gms. of water produced more change: the dicyanamide nitrogen rose to 1.13 per cent, the urea nitrogen to 0.71 per cent the cyanamide nitrogen fell to 13.61 per cent, and the ammonia nitrogen to 0.11 per cent. Very little change took place in the first ten days when 25 gms. of water was added but after 7 months, 2.58 per cent of dicyanamide was found. With 50 gms. of water profound changes took place and the material became a hard stone like mass; after 2 1/2 months and 7 months, the dicyanamide nitrogen rose to 7.51 and 9.17 per cent respectively, the cyanamide nitrogen falling to 2.81 and 0.28 per cent respectively in the same periods. Calcium cyanamide should not be stored after it has become wet -- it may be used immediately; the use of water to produce it in a granulated form is not likely to succeed.

1169 - **Manorial Experiments with Manganese Slag in Germany** — POPP M., in *Füllin Landwirtschaftliche Zeitung*, Vol. 65, Nos. 15 and 16, pp. 354-360. Stuttgart, August and 15, 1916.

Manganese slag is obtained in large quantities in Germany as a by-product in the manufacture of ferromanganese and spiegleisen. Its average chemical composition is given below:

	per cent		per cent
Manganese	24.4	Magnesia	6.3
Silicic acid	30.5	Sulphur	1.2
Alumina	9.8	Iron	traces
Lime	33.4		

The manganese is insoluble in water, but slowly soluble in weak acids. Its percentage occasionally rises to 30.

A series of pot experiments were carried out in which the manuring value of the manganese slag was compared with that of anhydrous manganese sulphate. The slag was used in a powdered form similar in fineness to basic slag. It contained 18 per cent of manganese and 32.26 per cent of silicic acid, and was applied to sandy soil made up of:

	per cent		per cent
Gravel	5.85	Lime	0.28
Coarse sand	15.10	Phosphoric acid	9.14
Fine sand	49.75	Potash	9.13
Clay	29.30	Nitrogen	9.13

Each pot contained 10 kgs of soil and received 1 gm. phosphoric acid, 1.5 gm. potash, 1.5 gm. nitrogen and 60 gms. of calcium carbonate in the form of marl, besides dressings ranging from 0.5 to 10 gms. of manganese either as sulphate or as slag. White Petkus oats were sown April 17 and harvested July 17. Manganese slag increased the yield both grain and straw in proportion to the amount applied except when the maximum dressing was used. In small amounts (0.5 and 1 gm) manganese sulphate was more effective than slag, but with the larger applications (2.5 and 5 gms), the order was reversed. Taking the maximum increase in yield as 100, the results of the experiments are as follows:

Amount of manganese applied gms.	Increase in yield due to manganese	
	Slag	Sulphate
0.5	13	33
1.0	44	52
2.5	69	62
5.0	90	57
7.5	100	—
10.0	91	—

With manganese slag the grain was affected more than the straw; with manganese sulphate the reverse was the case. Increase in yield

to slag varied in the first place with the size of the dressing and the solubility of the manganese, and to a less extent, with the nature of the soil and its manganese content.

Further experiments are recommended in order to decide whether heavy dressings of manganese slag may be employed with profit by farmers.

1170 - Comparative Study of the Root Systems and Leaf Areas of Corn and the Sorghums. — MILLER E. C., in *Journal of Agricultural Research*, Vol. VI, No. 9, pp. 311-331, Washington, May 29th 1916.

During the summers of 1914 and 1915 a series of investigations was conducted to determine the fundamental characteristics possessed by the sorghum plants (*Andropogon sorghum*) which enable them to withstand severe climatic conditions better than the corn plant (*Zea Mays*). The present paper deals with the comparative study of the root systems and leaf areas of corn and of the sorghums Blackhull Kafir and Dwarf Milo. These experiments were carried on at the State Branch Experiment Station at Garden City, Kansas, in latitude $37^{\circ} 58'$ north and longitude $100^{\circ} 55'$ west (Greenwich) and at an altitude of 2940 feet.

The root systems of Pride of Saline corn, Blackhull Kafir and Dwarf Milo sorghum plants which were grown in alternate rows, were isolated in the field at four stages of growth in 1914 and at three stages of growth in 1915. All told, the root systems of 33 plants were isolated and studied. It was found that for a given stage of growth each plant possessed the same number of primary roots and that the general extent of these roots in both a horizontal and vertical direction was the same for all three plants. The maximum depth of root penetration for mature Dwarf Milo, Blackhull Kafir, and corn was found to be 6 feet for both the years 1914 and 1915. Blackhull Kafir and Dwarf Milo possessed approximately twice as many secondary roots per unit of primary root as did the corn plant. This is true not only for both years but also for all stages of the root systems examined. Both primary and secondary roots of the sorghums were found to be more fibrous than those of the corn plant.

The relation of the weight of the dry matter of the aerial portions of mature plants to the weight of the roots was determined in 1914 for 36 Dwarf Milo plants, 30 Blackhull Kafir plants and 12 corn plants. In 1915 the same determinations were made for 24 Dwarf Milo, 14 Dwarf Blackhull Kafir, 23 Blackhull Kafir and 24 corn plants.

The average ratio of the dry weight of the grain, stem and leaves of standard Kafir to the dry weight of the roots was found to be 15 and 19 for the years 1914 and 1915 respectively, while the dry weight of the stem and leaves of the same plant was on the average 10.9 times that of the root weight in 1914 and 10.1 times the root weight in 1915. For Dwarf Milo the corresponding figures were 15.7 and 15; 9.6 and 8 respectively. For corn the weight of the stem and leaves was 9.6 times the root weight in 1914 and 7.8 times in 1915. For Dwarf Blackhull Kafir in 1915 the figures were 15.7 with the grain and 8.9 without the grain.

The results of the experiments in regard to the soil-moisture content and depth of root penetration seem to show that under the conditions of the

experiment very little, if any, depletion of soil moisture took place below the depth of root penetration.

The average leaf areas of five representative plants of corn Blackhull Kafir and Dwarf Milo were obtained at stages when the plants were 4, 6, 8 and 10 weeks of age. The last stage examined showed that the plants had completed their full leaf development. In all the stages of growth the corn plant was found to have the greatest leaf area. Taking the stages of growth in order, the leaf area of the corn plant was 1.7, 2.0, 2.2 and 2.3 times the leaf area of Dwarf Milo and 1.6, 1.9, 1.5 and 1.5 times of that Blackhull Kafir.

From the experimental results it is apparent that the Dwarf Milo and Blackhull Kafir plants would have the advantage over the corn plant under any climatic conditions that would tend to bring about a loss of water from these plants. The two sorgfums have, in the first place, compared to the corn plant, only one-half the leaf surface exposed for the evaporation of water; and in the second place they have a root system which, judging from the number of secondary roots, would be twice as efficient in the absorption of water from the soil.

1171 - Barium in Tobacco and Other Plants. — ARTIS B., and MAXWELL H. L., in *Chemical News*, Vol. 114, No. 2959, pp. 62-63. London, August 11th 1916.

Other workers (1) have found barium in various plants and, as this element is widely distributed in soils, the question has arisen as to whether it is really plant food, although it has not been found in all the species analysed. The writers of this article have examined the leaves and stems of tobacco grown in various places and also the leaves of several other plants, some of which were grown on soils containing 0.1312 per cent of barium sulphate. The chief results are summed up in the appended Table.

TABLE I. — Proportion of barium in tobacco grown in different places.

Kinds of tobacco and districts where grown.	Leaves		Stems	
	Ash	Barium sulphate	Ash	Barium sulphate
			per cent	per cent
Havana tobacco from Cuba	20.85	0.0608	25.68	0.0760
Broad leaf, grown in Pennsylvania	21.98	0.0648	21.62	0.0780
Havana seed grown in Connecticut	20.11	0.0600	19.38	0.0720
Pennsylvania tobacco, grown in Pennsylvania	21.48	0.0980	24.28	0.1280
Sumatra tobacco	20.87	0.0308	24.73	0.0408
Wisconsin tobacco, grown in Wisconsin . .	21.62	0.0192	24.49	0.0280
Tobacco grown in New York State	—	0.0132	—	0.0240

(1) See *B.* August 1913, No. 924.

(Ed.)

TABLE II. — *Proportion of barium in the leaves of various plants.*

Species	Time of cutting	Barium sulphate
		per cent
Dogwood	autumn	0.0224
Cotton wood	autumn	0.0052
	spring	0.0528
	autumn	0.0302
Cherry	spring	0.0134
Black locust	autumn	0.0324
Mulberry	autumn	0.0696
Elm	autumn	0.0356
Linden	spring	0.0182
Wild olive	autumn	0.0152
Plum.	autumn	0.0048
Box elder	autumn	0.0372
Hard maple	spring	0.0295
Walnut	autumn	0.0368
Pear	autumn	0.0752
Soft maple	spring	0.0196
Wild grape	spring	0.0273
Wild cherry.	spring	0.0941
Lime	spring	0.0336
Elderberry	spring	0.0435
Black walnut	spring	0.0143
Sumac	spring	0.0096
Blackberry	spring	0.0071
		0.0086

172 - Cereal Selection in Croatia, Austria Hungary. — MANDEKIC V., in *Zeitschrift für Pflanzenzüchtung*, Vol. II, Part. 2, pp. 161-192. Berlin, June 1916.

Wheat. — The selection of wheat was first carried out at Krizevci Agricultural High School, and dealt with indigenous and foreign varieties, the former proving to be the less productive. Among foreign varieties Sirban Prolific has given the best results up to the present. Its pedigree is unknown, but probably it is derived from a spring wheat. During five years experiments Sirban Prolific has given consistently higher yields than the wheats Banat, Friher Bastard, Renodlad, Golden Perle, Extra Squarehead, Imperial, and the best indigenous varieties. It has however the disadvantage that it cannot stand the winter cold. In 1911-1912 some hundreds of ears of Sirban Prolific were selected and the seeds were sown the following year. The best lines that were thus obtained were Red Sirban Prolific, White Sirban Prolific, Rust-resisting Red Sirban Prolific, Sirban Prolific with dark grey ears, Grey bearded Sirban Prolific.

As soon as the value of this variety was recognised, attempts were made to cultivate it in other parts of the country with satisfactory results.

In Croatia it is now grown on about 287 500 acres per annum, and much seed is exported to Dalmatia, Istria, Carinthia, Bosnia and Herzegovinia, where it is much appreciated. The selected lines mentioned above are not yet in the market, except one which is already well adapted to the needs of the country.

Selection at Krizevci is specially directed towards obtaining lines which are proof against lodging, rust, and winter cold. Wheat selection is also carried out in Croatia at the Plant Breeding Station on the Vukovar estate (recently founded by Count Eltz) and at the Ruma Station on the Pejacsevich estate.

Rye. — Foreign varieties of rye are less suited to the conditions obtaining in Croatia. The best results are obtained with indigenous varieties, especially with Potocec rye, which is very robust, possesses good straw, does not lodge, tillers well and has a long ear with long awns. The quality of the grain is good, with an average yield.

The aim of the work at Krizevci has been to obtain an early rye giving a good crop, but resistant to winter cold and to diseases. The method adopted is that of pedigree culture. Some good strains have already been secured, but they have only recently been distributed to the growers. It is hoped that by this means the rye production of the country will be considerably increased.

Barley. — Indigenous varieties are chiefly grown in Croatia, as foreign sorts are less resistant to rust. The former are early, not very susceptible to rust, and are of good quality, but their yield is not very high. All the winter sorts need to be sown early in order that the plants may make good root growth in the autumn. Those that have been selected are of good quality but the straw is weak so that they lodge easily.

With spring sown barley the best results have been obtained with foreign varieties. A 2-rowed barley derived from the original Kwassitzer Hanna by mass selection is particularly good. Since 1913, individual selection has been carried out. The aim has been to obtain a very early variety with a fairly stout straw, which tillers well and produces a long ear with uniform grains of low nitrogen content, furnished with thin glumes.

Oats. — Experiments have shown foreign varieties are much more productive than the native kinds. One of the best is Duppau which was imported from Hungary, but, in wet seasons it is badly attacked by rust. The best kinds are those with thin leaves, e. g. Heine, which has been submitted to individual selection since 1912.

Maize. — The first maize to be selected was an indigenous variety Round Croatian, which has been grown for some years in the experimental plots at Krizevci. In addition Pignoletto, American Horse-tooth and a very early variety Hangarii, derived from the high plateau of Bosnia, have been selected in order to obtain strains possessing ears with numerous straight rows of grains with much horny starch. In addition to this attention has been paid to the self-fertilisation and cross fertilisation of maize.

173 - Agricultural Value of Impermeable Seeds. — HARRINGTON, G. T., in *Journal of Agricultural Research*, Vol VI., No. 20, pp. 761-796. Washington D. C., August 14, 1916.

During the years 1909 to 1916 many germination tests of the seeds of clover, lucerne, winter vetch, okra (*Hibiscus esculentus* L.) and other plants were made for the purpose of determining the agricultural value of the impermeable seeds.

Impermeable seeds are those whose coats are impermeable to water at temperature favourable to germination. Such seeds have been described by numerous investigators under the term "hard seeds"; the more appropriate term "impermeable seeds" was introduced by GUPPY and is used in the present paper.

Some plants, cultivated or wild, produce both impermeable and permeable seeds; the percentage of impermeable seeds has been determined for some of these species, as follows:

Percentage of impermeable seeds in some cultivated plants.

	per cent
<i>Trifolium pratense</i> L.	9.61
<i>T. hybridum</i> L.	10.16
<i>T. repens</i> L.	17.30
<i>Millettia alba</i> Desv.	42.39
<i>Medicago sativa</i> L.	13.81
<i>Vicia villosa</i> Roth	20.97
<i>Vicia sativa</i> L.	0.96
<i>Vigna sinensis</i> (Turner) Savi	3.55
<i>Molinago hispida denticulata</i> (Willd.) Urban	48.08
<i>Medicago arborea</i> L.	71.67
<i>Molinago sativa falcula</i> (L.) Döll	49.72
<i>Medicago lupulina</i> L.	10.43

Most of the work reported in this paper was done with the seeds of clover, alsike clover, white clover, white sweet clover, alfalfa, hairy tick (Vicia villosa Roth) and okra. Some work was also done with musou clover (*Trifolium incarnatum* L.), black locust (*Robinia pseudoacacia* L.), kidney bean (*Phaseolus vulgaris* L.), pea (*Pisum sativum* L.), cowpea (*Vigna sinensis* Sair) and *Chamaecrista nictitans* L. Muensch.

The following conclusions were reached: It is impossible to distinguish between impermeable and permeable seeds except by testing their ability to absorb water at a temperature favourable for germination. The production of impermeable seeds is particularly characteristic of the Leguminosae, but it occurs also in many other plant families. Among the cultivated species which sometimes produce impermeable seeds are okra, lyhock (*Althaea rosea* [L.] Cav.), *Erodium cicutarium* [L.] Thér., *Atriplex* spp., asparagus, morning glory (*Ipomoea purpurea* [L.] Lam), canna (*Canna indica* L.), cherry tomato (*Physalis pubescens* L.) and nearly all the cultivated species of Leguminosae.

Impermeable seeds frequently retain their vitality for many years, sometimes for at least as many as 80 years. Fresh impermeable seeds

germinate promptly when the seed coat is broken or becomes permeable. The viability of fresh impermeable seeds is frequently greater than that of fresh seeds of the same species which are permeable. Seeds of the common clover, alfalfa and hairy vetch which are impermeable at the end of three to five years under laboratory conditions of storage retain their vitality apparently unimpaired up to that time. The viability of the permeable seeds in the same lots decreases slightly in the second and third year and more in subsequent years.

In dry storage nearly all impermeable alsike clover, white clover and sweet clover seeds remain impermeable until at least 2 or 3 years old. Impermeable red clover seeds become permeable gradually in dry storage, but from one third to two thirds of them may still be impermeable after four years. Okra seeds become less permeable as their age increases.

In wet blotting paper nearly all impermeable lucerne, crimson clover, hairy vetch and okra seeds soften and germinate in one year, though a very few may remain impermeable even after three or four years. Impermeable seeds of red clover, alsike clover, white clover and sweet clover soften and germinate more slowly, but with no uniformity as rate. All germinate within one year in some cases, while in other cases over 50 per cent are still impermeable after four years.

Impermeable clover seeds which were thoroughly matured before harvesting soften and germinate more slowly under conditions favourable for germination than do impermeable seeds of the same species which were less well matured; they also become permeable more slowly in dry storage. Impermeable seeds become permeable more rapidly in wet blotter than in dry storage.

It is impossible to estimate even approximately in advance the proportion of the impermeable seeds in any given lot which will germinate in any given length of time under ordinary germination conditions. A widely variable proportion of the impermeable seeds of lucerne, crimson clover and the larger seeded commercial species included in the investigation produce seedlings promptly in the soil under greenhouse conditions or in the open field in warm weather. Only in exceptional cases is this true of the impermeable seed of the clovers, other than crimson clover.

The use of aqueous extract from soil has no effect, and alternately wetting and drying of the seeds has but little effect on the germination of impermeable seeds.

Within ordinary limits, neither the depth of planting nor the firmness of the soil affects the germination of impermeable clover and lucerne seeds under greenhouse conditions. These factors may affect the stand secured by preventing some of the seedlings from reaching the surface.

Storing impermeable clover and lucerne seeds at a temperature of 122° F. for one day or 113° for six months has little or no effect upon the germinating capacity or permeability.

In wet blotting paper a temperature of 107° F. very slightly increases the softening of the impermeable seeds, but it also kills some of the seed.

Freezing when wet causes the subsequent germination of many impermeable seeds, but may kill some seeds which had previously softened. Any constant temperature from 34° F. has little effect upon the softening of impermeable clover seeds. Alternations of temperature have but little effect on the softening and germination of impermeable clover and alfalfa seeds if none of the temperatures used in the alternations are below 68° F.

Alternations of temperature cause the softening and germination of many impermeable clover seeds when a temperature of 50° F or cooler is used in alternation with a temperature of 68° F or warmer. The effect of such an alternation of temperatures is greatly increased by previously exposing the seeds to germination conditions at a cool temperature (50° F. or cooler), and is decreased by previously exposing the seeds to germination conditions at a warm temperature (86° F.)

Even under the most favourable conditions only a small proportion of impermeable red clover, alsike clover, white clover and white sweet clover seeds produce seedlings promptly when sown in warm weather.

Impermeable seeds of red clover, alsike clover, white clover and white sweet clover will pass the winter in the soil in a freezing climate without injury. A least 50 or 60 per cent of them may be expected to germinate in the soil the following spring unless some of them germinate during warm weather in the winter. If this occurs, the seedlings produced in the winter are liable to be killed by subsequent freezing.

A large proportion of impermeable lucerne, crimson clover, okra and hairy vetch seeds will germinate in the soil during the first few months after planting, some of them early enough to be of importance to the crop. Nearly all lucerne and okra seeds, even if they are impermeable in the autumn, are killed when they pass the winter in the soil or on the plants out of doors in a freezing climate. A small proportion of the impermeable lucerne seeds survive with their vitality uninjured. Some of the okra seed remain impermeable during the winter, but the majority even of those which remain impermeable are killed by the winter's exposure.

The following general rules, based upon the above conclusions and the experimental results, are suggested as guides in agricultural practice with impermeable seeds :

Then seed is to be sown in the late spring or summer.

Consider one tenth of the impermeable seed as good. Add one tenth of the percentage impermeable seed to the percentage of germination. Calculate from this sum the quantity seed of the given lot necessary to give the desired quantity of good germinable seed. This may be expressed in the form of an equation, thus :

$$\text{Number of lbs. to sow per acre} = \frac{\text{Number of lbs. of good seed desired per acre}}{\text{Percentage of germination} + \frac{1}{10} \text{percentage of impermeable seeds}}$$

For example, suppose it is desired to sow per acre 15 lbs. of viable seed, none of which is impermeable. Fifty per cent of the lot of seed to be used germinates and forty per cent is

impermeable. Considering one tenth of the latter, or 4 per cent, as good, then the amount of seed required per acre would be

$$\frac{15}{0.50 + 0.40} = \frac{15}{1.0} = 15 \text{ lbs.}$$

The impermeable seeds remaining in the soil during the winter will help to improve & thin areas in the stand the following spring, but this, however, should not be counted up
 b) *seeding in the late autumn or winter or in the spring a month or so before the end of freezing weather:*

Consider all the impermeable seeds as good. Add the percentage of impermeable seed to the percentage of germination. Using the figures as in the preceding case (a) the quantity of seed to use would be

$$\frac{15}{0.50 + 0.40} = \frac{15}{0.90} = 16.7 \text{ lbs.}$$

c) *When seeding in the spring after danger of severe frost is past, but a month or more before the end of cool weather:*

The general formula is

$$\text{Number of lbs. to sow per acre} = \frac{\text{Number of lbs. of good seed desired per acre}}{\text{Percentage of germination} + \frac{2}{3} \text{ of impermeable seed}}$$

With the same figures as before the quantity of seed required would be

$$\frac{15}{0.50 + \frac{2}{3}(0.40)} = \frac{15}{0.50 + 0.26} = 19.7 \text{ lbs.}$$

2. Lucerne and crimson clover.

The formula is again

$$\text{Number of lbs. to sow per acre} = \frac{\text{Number of lbs. of good seed desired per acre}}{\text{Percentage of germination} + \frac{2}{3} \text{ percentage of impermeable seeds.}}$$

More than two-thirds of the impermeable seeds may germinate, but the excess should be reckoned on.

3. Hairy Vetch.

$$\text{Number of lbs. to sow per acre} = \frac{\text{Number of lbs. of good seed desired per acre}}{\text{Percentage of germination} + \frac{1}{2} \text{ percentage of impermeable seed.}}$$

4. Okra.

$$\text{Number of lbs. to sow per acre} = \frac{\text{Number of lbs. of good seed desired per acre}}{\text{Percentage of germination} + \frac{1}{4} \text{ percentage of impermeable seeds.}}$$

More than one fourth of the impermeable seed will probably germinate but too late to contribute to a uniform stand.

1174 - The Seed of *Commelina communis* L. Characteristic of Seed Samples derived from the Maritime Region of Eastern Siberia. — ИСАЧЕНКО В. Л., Записки Станции для испытания сельскохозяйственных и императорского Ботанического Сада Петра Великого в Петрограде (Annals of the Seed Control Station at the Imperial Garden of Peter the Great Petrograd), Vol. III, Part 5, pp. 3-27. Petrograd, 1916.

As an auxiliary means of determining the place of origin of crop samples recourse may be had to the identification of the weed seeds which are mixed in the samples. This method demands numerous analyses

samples of seeds of cultivated plants and a complete botanical analysis of the weed seeds in order to be certain which of the latter may be considered as characteristic of a given district.

The investigations here described were made on seed samples from the maritime region of eastern Siberia, and were supplied to the seed control station by the Department of Agriculture. The samples were taken during the winter of 1910-1911, and they all belonged to the 1910 harvest. They were representative of the condition in which the farmers send the grain to the market or mill; this material obtained direct from the producers was exceedingly valuable for the botanical analysis of weed seeds.

The district was divided into seven zones according to the methods of cultivation adopted, and the results were grouped to correspond. This division, however, has no direct bearing on the problem in hand, and it has only been used in drawing up the tables for the benefit of those who desire to study the farm seeds used in the district.

Seed samples of cereals (wheat, rye, oats, barley), buckwheat and flax were examined. It appears that *Commelinia communis* L. family Commelinaceae Reich. is widely distributed in the district. In view of the fact that this plant is completely absent in samples of cereals derived from western Siberia, which have been analysed at this Station, it is considered that the presence of seeds of *Commelinia communis* L. may, taken as an indication that the samples come from eastern Siberia, probably from the maritime region.

In 1913 and 1915 *Commelinia communis* seeds from the 1910 harvest were sown in the Imperial Botanic Garden of Peter the Great, at Pétrograd, and they grew well in every case. This shows that the seeds retain their germinating capacity for a long time (it was still about 55 per cent at the end of six years and that the plant will grow in the west).

Commelinia communis seeds are earth colour and resemble bits of th in shape. The dimensions are: length, 2 to 4 m.m., breadth 1.5 to 2 m.m.; on the average, the length is 2.7 m.m., breadth 2.3 mm. The weight of 1 000 seeds averages 7.9 gms. and the weight of a single seed lies from 0.005 to 0.011 gm.

In Manchuria the colouring matter of the petals of *Commelinia communis* is used to dye cotton thread blue.

Among the harmful weed seeds found in the samples analysed, attention was attracted to those of *Agrostemma Githago*, which were much larger and heavier than the seeds of the same plant derived from certain districts of Russia in Europe (1). In this connection the following data may be given.

Avena fatua was also found. This has hitherto been regarded as unknown in the district under consideration but these experiments indicate that it must have been imported with cereal seeds; it is now well established even in the extreme East.

(1) See R. September 1916. No. 968.

(Ed.).

Figures relating to seeds of Agrostemma Githago from different places.

Locality	Weight* of 1000 seeds	Dimensions		
		gram	mm.	
Maritime region	9.7		length 2.6 x breadth 2.3	
Corncockle from the same region grown at Pétrograd	9.08	" 2.9 x " 2.3		
Province of Esthonia	5.8	" 2.2 x " 1.9		
Province of Volhynia	9.0	" 2.2 x " 2.4		

The average impurity is 4.38 per cent for wheat and 2.61 per cent for rye.

As regards grain diseases the presence of smut on wheat and *Fusarium* on oats and wheat was noticed. Ergotted rye was not found, and absence had already been indicated by other workers who had studied maritime region.

**CEREALS
PULSE
CROPS**

1175 - Results Obtained with the New Wheat Carlotta Strampelli in the Regio Experimental Fields in Italy (1). — STRAMPELLI N., in *Minerva Agraria*, Year XI, No. 11-12, pp. 123-125. Rome, June 15-30, 1916.

In 1914 the Italian Ministry of Agriculture made arrangements to establish several experimental fields in various agricultural institutes connected with the Ministry. The present paper is the report submitted to the Ministry, chiefly consisting of the various reports sent in by the directors of the agricultural institutes at which the trials were made.

The wheats raised by M. STRAMPELLI fall into two groups.

- 1) wheats suitable for the valleys of Central and Northern Italy (Gregorio Mendel, Carlotta Strampelli).
- 2) wheats able to stand drought, suitable for growing in South Italy (Dauno, Apulia, Majorca, Strampelli).

As the year 1915, during which the experiments were carried out, exceptionally wet, the tests made with the second group were valuable. On the other hand, those made with the first group of wheats were specially favoured by the conditions. The experimental results obtained with Carlotta Strampelli wheat are summarised in the following table.

At the State School of Viticulture and Wine-Making at Avellino GIULIO PARIS tested the effect of liberal nitrogenous manuring (1% sodium nitrate per acre) on the wheats Carlotta Strampelli, Gregorio Mendel and Risciola. The manuring caused the two latter to lodge; the former did not go down, and it yielded 2787 lbs of grain per acre.

Tests in different parts of the country will be again repeated before

(1) See also Dr. G. PATANÉ, The Selection of Cereals in Italy, in *R. June*, pp. 831-842.

(2) See *R. 1915*. No. 167.

CEREALS AND PULSE CROPS

1611

Where and by whom tested	Yield par acre	Remarks
State School of Agriculture, Caluso (Turin province)	— lbs	Varieties sent from the Rieti station gave higher yields than the others tested; they also proved less liable to lodging and disease, especially rust.
Agricultural organiser of Fabriano	1 764	Other yields were: Granella di Carpegna . . . 1 253 lbs Gregoire Mendel 1 235 " " Bordeaux 1 137 " The varieties kept the same order in their resistance to rust.
Agricultural organiser of Ferrara	2 646	Higher yield than white Inversible Vilimorin, Gentil rosso originario, Hybrid 40 Passerini, Rosso Olona, Gentil rosso bolognese N° 16, Cornia.
State School of Agriculture, Mola	2 452	Proof against lodging and rust; free from smut.
State School of Agriculture of Adria (at Brusugana)	2 999	Very suitable for growing in moist districts.
State School of Agriculture of Cividale in Friuli	2 425	Not at all liable to rust or lodging.
State School of Agriculture, Oghera	2 576	Better results than with Rieti, Inversible Vilimorin, Gros Bleu etc.
Beetroot for Testing, Noviglio	3 042	Distinguished by its earliness, heavy yield and resistance to rust.

This variety is distributed to the public, but up to the present the wheat lotta Strampelli, which has given very high yields (up to 3616 lbs acre) on the Rieti plain without lodging has proved to be equally upstanding in the local test. This resistance to lodging is due to its anatomical structure, as it is rich in radially elongated fibro-vascular bundles arranged in several rows. This structure enables the straw, to bend without breaking, even though battered by the wind and heavy rains. When the soil is free from weeds, especially those with climbing roots, the straw recovers itself completely very soon after the storm is over.

Hybrid Wheats, Gentil rosso x Noé, obtained by Professor Passerini (1). — TARUFFI D. in *Giornale di Agricoltura della Domenica*, Year XVI, No. 39, p. 341. Piacenza, September 24, 1916.

Professor PASSERINI has endeavoured to obtain by breeding a variety of wheat with all the good qualities of Gentil rosso, but less liable to

[1] See also, in R. June 1916, pp. 831-842, original article by Dr. G. PATANE; "The Cereals in Italy".

lodge. Noé was chosen for the second parent because it does not lodge easily and because it has a lower habit and a thicker and more lignified straw than Gentil rosso. Noé possesses two bad characters which need to be eliminated: 1) its liability to rust, caused by late ripening, 2) the exceedingly coarse quality of the straw.

These experiments were begun before 1900 and have been carried out at the Agricultural Institute of Scandicci (Florence); they have shown that the cross Gentil rosso × Noé is more successful than the reciprocal cross. After rigorous selection only two of the hybrids have been chosen, known by the number 40 and 46. These hybrids differ essentially from Gentil rosso in that they are of lower habit and that the plants are glaucous like Noé. The ears are hardly any shorter than those of Gentil rosso; the spikelets are more fan-like at the time of ripening; the awn of the glumes are stouter and shorter. The grains (caryopses) are light red in colour and somewhat resemble those of Gentil rosso. No. 40 has a very elongated ear which is more like that of Gentil rosso, while No. 46 has a dumpy, thicker ear resembling that of Noé. In the shape of the grain No. 40 comes nearer to Gentil rosso than No. 46 does to Noé.

These hybrid wheats have also been cultivated on the Experimental Farm of the Perugia High School and by various Tuscan farmers of Valdichiana and Valdinievole. They have shown marked productivity and higher degree of resistance to lodging than Gentil rosso, even when heavily manured.

1177 - Two Good Varieties of Italian Wheat, Gentil rosso and Gentil bianco. — DE RO A., in *Il Coltivatore*, Year 62, No. 26, pp. 234-239. Casale Monferrato, September 20th 191

The wheats Gentil rosso and Gentil bianco, have been extensively cultivated in Tuscany from very early times. They spread from the country to many parts of North and South Italy giving excellent results everywhere. The two varieties possess the following qualities: good yield, great adaptability (particularly Gentil rosso); good resistance to rust and lodging; high food value. Gentil rosso is suitable for late sowing so that it may also be used as a spring wheat. Both varieties are suitable for cold or even cold districts, and prefer light or heavy loams in good heart. Gentil rosso is less exacting than Gentil bianco as regards soil. The former is chiefly used for bread making.

The following characters distinguish the two varieties.

Gentil rosso. — *Ear*: Elongated, oblong in section; glabrous; color tawny, with brown tints shading to red at the edge of the glumes.

Spikelets: Rather crowded, glumes fairly long, awned in an increasing degree from the base to the tip of the ear.

Grain: Elongated, size average, heavy, colour reddish with dark shades, fracture distinctly starchy.

Gentil bianco. — *Ear*: Elongated, square in section; glabrous, white with clear yellow shades.

Spikelets: Not very crowded; glumes swollen, slightly keeled in the upper $\frac{2}{3}$ somewhat awned.

Grain: Rather plump; size average; heavy; colour yellow; starchy fracture.

Physico-chemical characters of the grain and flour of the wheats Gentil rosso and Gentil bianco.

	Gentil rosso	Gentil bianco
average weight of 100 grains	grams	5.4966
weight of 1 litre of grains	"	800,00
volume of 1 kilogram of grains	litres	1.250
average weight of 1 hectolitre of grains	kgs.	80,000
volume of 100 kilograms of grains	litres	125,000
number of grains in 1 kilogram		18,200
10 kgs grain ground in a stone mill and sifted with a 0.5 m.m. sieve yield:		
flour	kgs.	81.153
bran	"	18,847
kilograms of water needed to make bread from 100 kilograms of flour		56,390
kilograms of bread obtained from 10 kg dough		83,310
kilograms of bread obtained from 100 kg flour		104,610
loss of weight from the dough caused by:		
a) fermentation during bread making		6.06
b) baking		11.68
<i>Composition of flour (1916 crop):</i>		
water	%	9.70
dity	%	10.60
dry gluten	%	0.057
carbohydrates	%	27.40
foreign substances	%	64.98
rogen	%	3.42
tein matter	%	2.080
s	%	13.00
i	%	1.85
o	%	0.78

8 - Seeding Experiments with Single Grains of Wheat. — MANCINI C., in *La Rivista Agricola*, Year XII, No. 263, pp. 293-294. Rome, Sept. 16, 1916.

The experiments have been made in ordinary soil of good quality not of exceptional fertility, which might be considered as second-best for wheat cultivation. The variety "Romanello" was planted on

October 25th. on plots of 120 square yards. Plot I was sown with single grains 4 inches apart each way; Plot II was also sown with single grains but 8 inches apart each way; Plot III, which served as a control was sown in the ordinary way, in rows 16 inches apart. The season was not very favourable, because of the dry spring.

The results of the experiment are given in the following Table:

Plot number	Distance between the grains	Number of grains sown per sq. yd.	Weight of grain sown per sq. yd.	Crop obtained per sq. yd.	(Crop Seed sown)	Crop per acre
			oz.	oz.		lbs.
I	4 inches	84	0.06	6	100	1700
II	8 inches	42	0.03	3	100	880
III	in rows	420	0.3	3	10	140

It is thus seen that by sowing only 0.06 oz. of seed per square yard, equivalent to 18 lbs. per acre, a crop of 1700 lbs. of grain per acre was obtained in spite of the unfavourable season. By this method 72 lbs of seed may be saved per acre.

1179 - **The Time to Seed Wheat in Kansas.** — CALL L. E. SALMON S. C., and CUNNINGHAM C. C., in *Kansas State Agricultural College, Agricultural Experiment Station, Bulletin No. 213, pp. 1-16*, Kansas, July 1916.

An account is given of investigations as to the best time to sow wheat when climatic conditions (cold winter, very dry summer etc.), the attack of Hessian fly (*Cecidomyia destructor* Say), and other intervening factors are taken into consideration. The damage caused by Hessian fly has been estimated at 16 million dollars (about £ 3 333 333) for 1915 and 15 million dollars (£ 3 125 000) for 1916. Experiments have been carried on for four years and it seems that in central and eastern Kansas wheat may be sown late enough to avoid most of the injury from Hessian fly yet early enough on well prepared ground to secure a good growth before winter.

The best date for seeding in north eastern Kansas varies from about September 25th, to October 3rd; in south central Kansas from about September 25th to October 7th; and in north central Kansas from about September 20th to October 1st. The time for seeding in western Kansas depends on the rainfall. It is usually not advisable to seed in dry ground. The land should be prepared early, and seeded when in proper condition to insure germination and good growth.

Wheat may be sown later in rich soil and well prepared ground than in soil that is poor or poorly prepared. Early and thorough preparation not only destroys many of the flies in the stubble, but also enables the wheat to make a more rapid and vigorous growth. Strong wheat plants are damaged less by Hessian fly, and stand more severe winter weather, than

plants which are small and weak. Wheat should be sown somewhat thicker when planted late. Late planted wheat often germinates less freely and usually tillers less, than wheat sown earlier, as is shown in the following Table.

The effect of the time of seeding on the tillering of wheat.

Date of seedings	Number of tillers per plant				
	1912	1913	1914	1915	Average 4 years
September 8 to 11, inclusive . . .	5.8	4.8	4.8	3.6	4.7
September 13 to 19, inclusive . . .	6.0	4.1	4.2	4.9	4.8
September 21 to 25, inclusive . . .	4.3	3.1	3.8	4.1	3.8
September 27 to October 2, inclus. . .	2.7	3.0	3.7	3.7	3.3
October 4 to 9, inclusive . . .	1.8	2.1	3.2	2.8	2.5
October 11 to 17, inclusive . . .	1.4	1.1	1.9	2.4	1.7

1180 - A Study of the Problem of Forage Production in Uruguay, dealing with the use of Artificial Inoculation in the Lucerne Fields. — MOREIRA A. S., and MENDIZABAL M. F. in *República Oriental del Uruguay, Ministerio de Industrias, Inspección Nacional de Ganadería y Agricultura, Bulletin No. 18. Montevideo, 1916.*

FORAGE CROPS,
MEADOWS
AND PASTURES

In order to increase the forage production in Uruguay the following tops have been tried:

- 1) Grass and clover mixtures.
- 2) Oats.
- 3) Lucerne.

All these have been more or less unsuccessful. Owing to the geological formation of the soils in Uruguay it is not possible to establish permanent lands of lucerne, as has been done in the Argentine pampas, where the plant continues productive for more than 40 years.

As lucerne could not be grown under irrigation in the fields of the National Inspectorate of Livestock and Agriculture, experiments were made to see whether it could be grown with the aid of deep ploughing and inoculation of the fields with nitrugin obtained from the United States Department of Agriculture. In the present paper the results of the second of experiments are given.

Preparation of the soil. — The experimental plots measured $16 \frac{1}{2} \times 33$ feet, and were on a very light sandy soil containing a fair amount of humus, which had been under potatoes from the spring of 1914 to the middle of January 1915 and had then been left fallow till the beginning of May. The plots were worked to a depth of 19 inches and were then harrowed on May 20th.

Time and method of sowing; quantity of seed used. — The four plots

FORAGE CROPS, MEADOWS AND PASTURES

TABLE I.—Analyses of lucerne hay from plots inoculated with nitrugin and from non-inoculated plots
(per cent of dry matter at 110° C.).

	Olfinger	AES	Cold water	Crude fat	Nitrogen	Protein	Phosphoric acid in ash	Nitrogenous extract in meteric as expressed acid	Starch value	Kellner
<i>Lucerne hay:</i>										
1) With nitrugin mixed with seeds	89.8	10.13	2.61	22.59	3.49	21.81	0.71	2.27	40.55	2.09
2) With nitrugin mixed with soil	88.90	11.09	2.86	21.95	3.55	22.19	0.75	2.00	41.86	2.06
Average of inoculated plots	89.38	10.61	2.73	22.27	3.52	22.00	0.73	2.13	41.20	2.07
Control for plot 1	89.08	10.92	2.59	24.11	3.30	20.63	0.72	2.14	44.08	1.98
Control for plot 2	88.69	11.30	2.65	22.78	2.79	17.44	0.84	1.15	45.80	2.76
Average of non-inoculated plots	88.86	11.11	2.62	23.44	3.04	19.03	0.78	1.64	44.94	2.37
<i>Leaves:</i>										
1) With nitrugin mixed with seeds	87.14	12.16	3.06	23.82	4.49	28.06	0.90	2.65	32.19	1.74
2) With nitrugin mixed with soil	86.92	13.10	2.93	20.92	3.76	23.59	0.85	2.49	39.54	2.06
Average of inoculated plots	87.03	12.63	2.99	22.37	4.12	25.75	0.87	2.57	35.86	1.00
Control for plot 1	85.90	14.09	3.15	18.21	3.72	23.24	0.79	2.97	41.29	1.52
Control for plot 2	88.70	11.29	2.41	23.25	2.87	17.94	0.71	1.93	45.10	1.87
Average of non-inoculated plots	87.30	12.09	2.78	20.13	3.29	20.59	0.75	2.45	43.19	2.69
<i>Stems:</i>										
1) With nitrugin mixed with seeds	93.60	6.39	1.40	44.18	1.85	11.56	0.52	1.29	36.45	1.68
2) With nitrugin mixed with soil	93.64	6.35	1.16	39.35	1.47	9.19	0.54	1.34	43.94	1.99
Average of inoculated plots	93.62	6.37	1.28	41.76	1.66	10.37	0.53	1.31	40.19	1.83
Control for plot 1	92.57	7.20	1.29	37.93	1.74	10.88	0.55	1.25	42.66	1.09
Control for plot 2	93.89	6.10	1.18	36.87	1.20	7.50	0.52	1.05	48.34	1.79
Average of non-inoculated plots	93.23	6.05	1.43	37.40	1.47	9.19	0.53	1.75	45.50	1.44

Source: Nitrugin was obtained from the Nitrofertilizer Company, Inc., New York, N.Y. The analyses were made by the Bureau of Soils, U.S. Department of Agriculture.

were sown with Grimm lucerne on May 21st with a Planet drilling machine, in rows 6 inches apart and $\frac{1}{2}$ inch deep; at the rate of $17 \frac{1}{2}$ lbs. of seed per acre.

Methods of inoculation. Two methods were adopted:

1) On one plot the nitragin ($17 \frac{1}{2}$ oz) was mixed with the seed ($3 \frac{1}{2}$ oz) and the mixture was sown in drills. The objection to this method was that the dampness of the nitragin caused the drilling machine to work idly. To mitigate this as far as possible a little dry sand was added to the mixture, with good results. A non-inoculated plot served as a control.

2) The same quantity of nitragin was incorporated with the soil immediately before sowing. The nitragin was scattered by means of a rye, raked in, and the seed sown directly. Again a non-inoculated plot was used as a control.

Growth up to time of cutting. Diseases. Germination began three days after sowing and was finished by the fifth day; this was attributed to the good quality of the seed and to the excellent condition of the soil, which was in good heart. After this, no further growth took place until July 10th, during the whole period of intense cold. Uniform growth followed on all the experimental plots until October 23rd, by which time a difference was evident between the inoculated and control plots. The former showed a more tufted growth and a deeper green colour.

During the whole period of vegetative growth the climatic conditions were not very favourable.

At the end of September the presence of a cryptogamic disease (*Pseu-*
spiza Medicaginis) was noticed. The inoculated plots showed a resistance to this disease which can only be attributed to the nitragin.

Chemical analysis. Nutritive value. — The figures set out in Table I show that the difference in the composition of the crops from the inoculated and non-inoculated plots is not great enough to be established by a simple analysis. The only well marked difference is that the crops from the treated plots were larger than those from controls. (Table II).

TABLE II. — *Yields of Lucerne from Inoculated and non-inoculated plots.*

	First cutting		Second cutting		
	Yield per acre		Yield per acre		
	Green crop	Air-dried hay	Hay in green crop	Green crop	Air-dried hay
	lbs.	lbs.	per cent.	lbs.	lbs.
Nitragin mixed with seed	6 821	1 902	27.88	9 856	2 742
Nitragin mixed with soil	6 856	2 003	29.21	10 921	3 096
Control to 1	4 083	1 193	29.22	8 721	2 345
Control to 2	4 057	1 264	31.14	7 744	2 102

Although the yield from the inoculated plots was almost double at the first cutting, it remains to be seen whether the difference will reappear in later cuttings.

On the basis of yield in green or dry weight at current prices, inoculation resulted in a financial gain of 27s 6d per acre, taking the average yield of the first cutting of the two test plots compared with that of the controls. In commercial dealings with forage in Uruguay the price is never based on the feeding value.

Discussion of results and conclusions. — The following conclusions are based only on the results of the first cutting, and further data are necessary to confirm them:

- 1) The influence of nitrugin does not manifest itself during the periods of germination and early growth.
- 2) During the period preceding flowering the effect of nitrugin shows itself in increased and more vigorous growth.
- 3) The yield from inoculated lucerne fields is greater than that from untreated fields.
- 4) Inoculated lucerne fields offer greater resistance to the attack of *Pseudopeziza Medicaginis*.

The figures of the second cutting, given in Table II, confirm the foregoing conclusions.

1181 - **The Forage Question in Aragon, Spain.** — LAPAZDRÁN J., in *Ministerio de Fomento, Dirección general de Agricultura, Minas y Montes*, Year X, No. 16, pp. 1-16. Madrid, August 1916.

The objection to lucerne growing arises chiefly from the fact that this crop occupies the land for several years, and the suggestion is made that it should be replaced by clover or, better still, by *Vicia villosa* (winter or spring varieties) or by *V. sativa* (autumn variety). The vetches do not occupy the land for more than 8 or 10 months, so they may be grown as a catch crop on the cereal stubble before the ground is occupied the following season by transplanted mangolds or maize grown for grain.

On well worked and manured Aragon soils which are not too damp the yield of vetches is 11 to 12 tons per acre of green forage or 2 $\frac{1}{2}$ to 3 tons of hay per acre.

Rotations used in the provinces.

State Experimental Farm of Saragossa	Non-irrigated new soils
—	—
1) Sugar beet	1) Fallow
2) Wheat or clover	2) Oats
3) Clover	3) Vetches
4) Wheat	4) Wheat
5) Vetches and maize	
6) Wheat or clover	
7) Clover	
8) Wheat	

Example of an average farm account for 1 acre of vetches, grown as a first crop on rather gravelly, calcareous clay soil, on the plain of Saragossa.

EXPENSES.	s d
<i>Preparation of the soil:</i>	
pairs of oxen for Jaén plough	7 8
" " " Brabant "	10 3
" " " " "	7 8
horse for harrow.	1 7
days labour for preparing the soil for irrigation.	2 11
	<hr/>
	s d
<i>Manure.</i>	30 1
3 lbs. superphosphate, and cost of transport.	6 6
½ day for labour for spreading manure	4
	<hr/>
<i>Irrigation expenses.</i>	6 10
days labour for irrigations.	—
<i>Cost of seeding.</i>	1 5
12 pints of vetch seed	14 4 1/2
8 pints of oats for mixing in	2 0 1/2
1 day labour for sowing seed	8 1/2
3 pairs animals for covering seed.	5 9 1/2
	<hr/>
<i>Cost of hay making.</i>	22 11
days labour for cutting	8 8
" " " making and loading hay	3 6
horse for 1 day to draw hay to barn.	1 7
	<hr/>
<i>Rent of land and general expenses</i>	13 9
colored together as 675 2d of which one half is debited to the first crop (vetches) and the other half to the second crop	33 7
	<hr/>
RECEIPTS.	108 7
tons 12 1/2 cwt. dry hay	137 0
	<hr/>
Net gain per acre	28 5

Estimating the value of the land at about £ 11 per acre the return would be about 25 per cent, half being made by the first crop and half by the second, over and above the improvement of the soil by the residues left by the leguminous plants.

82.—**Experiments with Potash Manures on hops in Germany.**— ANCKER F., in *Wochenschrift für Brauerei*, Year 33, No. 35, pp. 273-275. Berlin, August 26, 1916.

The report of the Berlin Experiment Station and School of Brewing given on experiments made in 1915 to determine the influence of artificial manures on the quality of hops. Each experimental field was divided into 4 plots separated by one or two rows which are not included in the results.

At the beginning of the experiment each plot received the dressing of dung that is usually used in the district, and in addition the following manures were applied per acre.

- Plot I. No artificial manure.
- Plot II. 115 lbs. sulphate of ammonia + 266 lbs. superphosphate.
- Plot III. 115 lbs. sulphate of ammonia + 266 lbs. superphosphate + 132 lbs. potassium salts (40 per cent).
- Plot IV. 115 lbs sulphate of ammonia + 266 lbs. superphosphate + 203 lbs. potassium salts (40 per cent).

With 1920 plants to the acre, each plant receives:

- Plot II. 0.19 oz. nitrogen + 0.40 oz. phosphoric acid.
- Plot III. 0.19 oz. nitrogen + 0.40 oz. phosphoric acid + 0.44 oz. potassium.
- Plot IV. 0.19 oz. nitrogen + 0.40 oz. phosphoric acid + 0.68 oz. potassium.

The farm yard manure was applied at the rate of $2\frac{1}{4}$ to $3\frac{1}{4}$ lbs per plant, and the artificial manures were spread from the end of March to mid-April.

The following are the details of the cultivation and the description of the soils used.

Experiment

- 1 Peaty sand, 10 to 12 inches deep; 240 plants per plot trained up poles.
- 2 Peaty sand about $1\frac{1}{2}$ inches deep over sand; 260 plants per plot, trained up poles.
- 3 Peaty sand, over sandy subsoil; plants trained up poles.
- 4 Peaty sand to a depth of 16 inches, then ferruginous sand; 300 plants per plot trained up poles.
- 5 Peaty sand; 240 plants per plot, three-fourths trained on iron wire, one-fourth trained up poles.
- 6 Boggy soil; 270 plants per plot, five years old, trained up poles.
- 7 Peaty sand; plants trained up poles.
- 8 Peaty sand to a depth of 14 inches, then sand; 160 plants per plot, trained up poles.
- 9 No data.
- 10 Peaty sand; plants trained up poles.
- 11 Peaty sand 12 inches deep, over a sandy subsoil; plants trained up poles.
- 12 Peaty sand to a depth of 14 inches; subsoil sandy; 300 plants per plot trained on wire.

The yield of dry hops per 100 plants on the various plots was as follows:

Experiment	Plot			
	I	II	III	IV
	lbs.	lbs.	lbs.	lbs.
1	29.92	27.50	33.00	35.20
2	29.70	31.90	36.30	40.48
3	19.80	20.46	21.12	22.00
4	22.00	25.52	27.06	23.32
5	20.24	23.76	26.40	30.14
6	35.42	38.72	36.52	38.72
7	22.44	32.12	33.00	30.52
8	13.86	14.52	15.18	15.40
9	5.06	4.62	4.40	4.18
10	9.02	10.78	11.44	12.98
11	3.52	3.96	7.04	9.02
12	25.52	27.72	29.26	29.46

It appears from these results that artificial manure considerably increased the yield in nearly every case without causing any depreciation of quality.

The average amounts of bitter substances in the dry matter are:

Plot	per cent
I	17.24
II	17.35
III	17.28
IV	17.05

Thus no average increase in bitter substances is evident.

If, however, the individual experiments are considered it is found that the plots come in the order III, II, IV, I with regard to the amount of bitter substances they contain. In type and size of the strobiles the order is plot III, IV, II, I; in lupulin content, plot IV, III, I, II; in colour of the hops plot I, I, III; IV.

To sum up, from the point of view of quality plot III has given the best result seven times and plot IV five times, the other two plots never taking the first place. The conclusion may be drawn that the quality has been most improved on plot III. It is closely followed by plot IV, which comes second simply because the foliage of the plants was more luxuriant than on plot III.

183 - Preliminary Work at the Chemical Laboratory of the Soukhoum Experiment Station, Caucasus, on the Extraction of Medical Substances from Local Plants (Eucalyptus, Wild Mint, Camphor, Castor Oil, etc.). — Козловъ М. Н. (Kozlov M. N.), Черноморское Сельское Хозяйство (The Agriculture of the Coast of the Black Sea), Year XIII, No. 1, 2, pp. 20-39. Soukhum, Jan.-Feb. 1916.

Numerous observations made by the Acclimatization Section of the Soukhoum Station have shown that it is quite practicable to cultivate species of Eucalyptus, rich in essential oils, on the Batum coast. The first attempt to extract these oils was successfully made in 1899-1900 by BEKLEMICHEV at his essential oil factory, but after his death the work is not carried on.

In order to throw further light on this question, investigations have been made on the leaves and stems of the following species: *Eucalyptus Globulus*, *E. Maidenii*, *E. amygdalina*, *E. viminalis*, *E. pulverulenta*, *E. crebra* and others.

The quantity of essential oil in the eucalyptus is greatest in the spring and early summer. Beklemichev's researches showed that in September 8 per cent of oil was extracted from *E. Globulus*, 0.7 per cent in December, and 0.9 per cent in March. Tests made in September with *E. viminalis* gave 0.6 per cent instead of 0.7 per cent; similar results were obtained with *E. pulverulenta*, which yield 1.8 per cent instead of 2.2 per cent. Fresh

leaves of *E. Globulus* yielded 1.1 per cent of oil; dried leaves gave 2 per cent; in *E. viminalis* the figures were 0.6 per cent 1.24 per cent respectively. The drying of the leaves also resulted in smaller quantities of condensation water, so that the expense of fuel for distillation was less. On the other hand, dessication did not cause any loss of essential oil.

From the chemical standpoint *E. Globulus*, *E. Maidenii* and *E. pulcherrima* may be classed together, as they yield very similar oils, containing over 40 per cent eucalyptol. It has been proved that these three species will grow well on the coast of Batum and that they can be cultivated on a large scale. The total leafage of *E. Maidenii* is heavier than that of *E. Globulus*. This fact, together with the higher oil yield of the former species, must have some effect on the return from its cultivation. It has also been proved that the eucalyptus oil obtained from the Batum coast is not inferior in quality to that derived from other countries; on the contrary, for *E. Globulus* and *E. Maidenii* the quality is superior.

The probable expenses and receipts of the production and commercial extraction of essential oils may be summarised thus: capital for layout out plantations £ 19 per acre; annual expenditure about £ 8 per acre; return of £ 19 4s to £ 22 8s per acre may be expected, representing interest at the rate of 13 to 30 per cent on a capital of £ 2600 to £ 3200, laid out on 25 to 50 acres of land and on the building of the factory.

Other interesting investigations have been made on wild mint (*Mentha Pulegium*) and Castor oil. The results are quite satisfactory; the yield of essential oil from fresh mint was 0.4 per cent, and after drying in air 1.09 per cent; in castor oil seeds the proportion of oil reached 49.5 per cent.

By using the fresh leaves of a tree of *Cinnamomum Camphora* Nees (about 20 years old), 0.9 per cent of raw camphor was obtained; 22.6 per cent of the total quantity consisted of oil of camphor, the remaining 77 per cent being camphor. Experiments with large branches 1 1/2 to 2 inches in diameter, gave negative results; no separation of solid camphor took place, but a small quantity (0.09 per cent) was obtained of an oleaginous substance with a peculiar smell which recalled that of camphor. (1)

(1) According to Prof. GUGLIOLI the distribution of camphor in the different parts of *Cinnamomum Camphora* growing in Italy is as follows:

Number of analyses		Proportion of camphor per cent
97	In fully developed green leaves	1.20
	In young leaves	0.70
6	In dried leaves	2.18
14	In young wood	0.10

"It thus appears that only the foliage of the camphor tree should be used, the old leaves being taken by preference and dried. This applies at any rate, to those trees which are similar in species to those that are becoming less and less frequent in the forests of Japan and Formosa." (Ed.)

Cultivation and Marketing of Flowers and Early Produce on the Riviera from Toulon to Mentone. — FONCIN M., in *Annales de Géographie*, Year XXV, No. 136, pp. 241-262. Paris, July 15, 1916.

HORTICULTURE

The cultivation of flowers and early produce occupies the whole coast from Marseilles to Mentone, a zone which comprises a purely agricultural one. The land is undulating and the soil is very variable, including alluvium on the plain of Hyères, the gneiss and mica-schists of Maures, recent eruptive rocks of Esterel and finally the calcareous or marlyimentary beds. It is because of the climate — a Mediterranean climate tempered with mild winters and dry summers — that the whole region is given over to agricultural pursuits. All the rain falls in the autumn winter, and then it comes in heavy downpours. Sowing must be done after the rains to ensure a harvest before the end of spring, as only wheat, and fruit trees can stand the dryness of the summer. Attempts have been made to anticipate the rainy season by means of summer irrigations, either by utilising the subterranean waters or by diverting the water courses. All the seeds sown are obtained from cold countries, as they grow into growth so much more quickly than those raised locally.

In the Maures there is a fairly brisk trade in wild flowers. Among cultivated plants the orange (harvested in May) and mimosa are prominent. Roses are grown in the open air and in glasshouses, carnations unmatting (Hyères, Maures) or under handlights (shores of the Maritime Alps, especially at Antibes), violets as undergrowth in fields planted with olives or peaches. Ornamental plants are also grown. Kitchen-gardens are almost entirely confined to the plain of Hyères. In fruit-growing the cultivation of citrus fruits is not very important; peaches, nectarines and figs are the trees which succeed best; the grape is also a very important product.

In some cases the land is leased without payment in return for the clearing of some of the waste land. Some landlords insist on the growing of old crops (vines, olives, wheat) as well as fruit and early produce. Under these circumstances the family of the tenant provides sufficient labour for the work. In other cases only flowers or early crops are grown, in which labourers are necessary; the land is taken on lease, usually for long periods. Finally there are big horticultural establishments devoted to house work only, which specialise in the cultivation of one or two articles (roses, carnations). The aim of each firm is to create a new variety. Unfortunately there is no law of agricultural property to safeguard the rights of the creator of a new variety. In these great establishments the amount of labour employed is considerable. The figures referring to such firms are as follows:

Area of land cultivated	37 $\frac{1}{2}$ acres.
80 carnation houses covering	200 000 sq. ft.
60 rose houses covering	60 000 sq. ft.
Frames	14 000
Output, per annum	18 000 baskets
Working expenses	£4 000

Cost of straw	£48
Cost of string	£48
Upkeep of frames	£68
Plumbing etc.	£120
Labour	£2 400

The flowers are sent away by parcels post, in reed packages lined w paper or wadding to keep out the cold. The very delicate fru buried in wood packing, travel in boxes, while the more hardy vegetab content themselves with baskets and even sacks. Only the very earl spring crops, fruits or vegetables, benefit by more dainty packing in lit boxes or quite small flats, which are forwarded by parcels post. The jour is very rapid, the goods reach Paris in $20\frac{1}{2}$ hours, Frankfort on-M in 33 hours, London in $38\frac{1}{2}$ hours, Brussels in 39 hours, Pétrograd in hours and Moscow in 95 hours.

From the agricultural point of view, flowers and early produce ha taken the place of wheat, which used to be grown in the rows betwe the vines. The olive trees have begun to be neglected; only the vi holds its own. The change of crops has had a great influence on the l of the region and has modified the distribution of the population, hitherto crowded together in the villages and old towns; today these old villa are replaced by scattered dwellings in proximity to the gardens and t transport centres. The influence of the new method has also made its felt by developing relations with other countries and by giving an impu to cooperation.

The growing of flowers and early crops has greatly increased t wealth of the country, the value of the products sold each year reach £ 2 200 000; it has also resulted in the creation or development of such i dustries as perfumery, distilling, confectionery and the manufacture of pac ing materials. Finally it has exercised an ethnographical influence l encouraging the immigration of foreign labourers who frequently sett down to live in the country.

FRUIT GROWING

1185 - Mountain fruit Growing in Switzerland : Varieties Introduced from Russ Sweden and Denmark. — See No. 1158 of this Bulletin.

1186 - Banana Growing in New South Wales. — *The Fruit World of Australasia*, Vol. XV No. 8, p. 270. Melbourne, August 1, 1916.

The cultivation of the banana is extending rapidly in the distr of Tweed and Brunswick River. Orchards of commercial importa planted with the variety Cavendish, which is much superior to the o nary banana in quality and aroma, occur chiefly at Terranora, Piccal Bilambil and Cobaki. 300 to 400 plants are grown per acre, and the plan tations are usually from 10 to 25 acres in extent, but some are much larg The first crop of 1 cluster of bananas per plant is gathered from 16 to months after planting; the following year the crop increases to 40 clusters per plant. In 1915, at Bilambil, the crop from one plantation valued at £ 2320, a gross return of £ 232 per acre.

The cost of planting one acre with 400 banana trees varies from £ 10, £ 14 10s. according to the price of the plants, which ranges from £ 1 12s to 2 8s per hundred. Land suitable for banana growing costs from £ 29, £ 54 per acre, and plantations in full bearing are valued at about 96 per acre.

187 — Effect of Drought on the Size of Grapes. — RAVAZ L., in *Le Progrès Agricole et Viticole*, Year 33, No. 35, pp. 199. Montpellier, August 27, 1916.

During the prolonged drought of the summer of 1916 in the South of France some measurements were made of the sizes of grapes.

Number in order on the bunch	Normal vine		Vine suffering from drought
	—	mm	
No. 1	22.5		18.5
No. 2	23.0		16.2
No. 3	22.7		17.4
No. 4	23.4		16.5
No. 5	22.5		18.3
No. 6	23.3		16.4
Average	23.2		17.2

Being given that volumes are to one another as the radii raised to the third power the ratio 1549.29 : 636.05 is obtained; in other words, the berries which have suffered from drought are nearly three times as small as normal grapes.

3 - Spanish Forests and Paper Manufacture. — ELORRIETA O. in *Resumen de Agricultura*, Year XXVIII, Part 9, pp. 399-402. Barcelona, September 1916.

The Spanish market uses annually 28 000 tons of paper, of which newspapers account for one half. Spain produces 15 000 tons of mechanical pulp per annum, from which an approximately equal weight of paper is manufactured. Consequently she is obliged to import 3 000 to 4 000 tons of mechanical pulp and 10 000 tons of chemical pulp.

Trackless forests. — It is asserted that there is sufficient wood in Spain to cover the amount of the imports and that it is the lack of roads which hinders the working of the woods under economic conditions. In Spain the raw material for paper making is not very costly, but no-one cares about it and the forests remain practically unused. As an instance may be cited the magnificent fir woods of the Aran valley consisting of *Abies pedinata*, the species best adapted to paper making. A beginning has been made in the management of 37 500 acres, and the yield from these woods reached nearly 16 000 cubic yards. Unfortunately the work was stopped on account of administrative difficulties connected with boundaries and other questions of secondary importance.

Workable woods. — In the Pyrenees of Aragon and Catalonia, chiefly in the provinces of Huesca and Lerida, there are 122 500 acres of firwoods capable of providing 39 000 cubic yards of wood per annum. As the wood

has a high moisture content this quantity would make about 15 000 tons of mechanical pulp or 10 000 of chemical pulp, which is nearly enough to tide over the crisis that the war has caused in the paper trade. It does not seem possible to work these 122 500 acres in an intensive manner all at once, and it is suggested that the working of the Aran valley, mentioned above should be continued; the 39 000 cubic yards of wood obtained would be equivalent to 6 000 tons of mechanical pulp or 4 000 tons of chemical pulp.

The remainder could be provided by the pine forests (*Pinus sylvestris*) of Soria, Burgos, Sierra Carpetana and Cuenca. The Spanish pine wood contains more resin than that from the Baltic and Sweden and consequently is less suitable for paper manufacture. Nevertheless this species occurs at various altitudes, and it is probable that *Pinus sylvestris* from the dense woods of the higher parts of the country closely resembles that from Northern Europe.

The conclusion is drawn that the problem of providing raw material for paper making could be solved if the Forest Administration were to take the matter up seriously.

Transport. — This is a more difficult problem to solve than the preceding one. In practice the freight from Sweden to Spain, to Pasajes (Guipzcoa province) is lower than the cost of transport from Sierra Guadarrama (province of Madrid and Ségovia) to Guipzcoa or Biscay, where important Spanish paper factories are situated. The Government may prevail upon the railway companies to concede a lower tariff, but it cannot improvise means of road transport.

The Spanish paper industry has a producing capacity great enough to meet the needs of the country : the Spanish Papermaking Company is responsible for 68 per cent of the total output. Apparently means are available to produce the whole of the mechanical pulp necessary, but not the chemical pulp, because the manufacturers are not provided with the needful plant. The paper factory at Villalba (Navarra) is an exception to this, as it produces a small quantity of semi-chemical pulp.

Replanting with poplars, especially Canada poplar, is suggested as a means of providing the most rapid solution of the problem, while at the same time it would give a return of 12 to 14 per cent on the capital outlay.

LIVE STOCK AND BREEDING

FEEDS
AND FEEDING

1189 - Influence of Feeding with Milk rich in Carbohydrates (Diafarinised) and Milk rich in Fat (Emulsion Milk) of Varying Protein Content, on the Composition of Young Pigs (1). — WEILMANN, O. (Zootechnical Institute of the Royal Veterinary School of Budapest) in *Kisérletügyi Közlemények* (Communications of the Agricultural Stations of Hungary) Vol. XIX, Part 1, pp. 84-164, 35 tables (German summary pp. II-167). Budapest, January to June 1916.

In these experiments young male pigs of the Berkshire breed were fed from the 23rd to the 39th day on a ration composed partly of diafat

(1) See R. January 1916, No. 89.

ised milk (skim milk to which flour-starch saccharified by a preparation of diastase has been added) and partly of emulsion milk (skim milk emulsified with a cheap substitute for milk fat). These rations had the nutritive ratios: narrow ($1:2.5$) ; fairly narrow ($1:4.5$) ; fairly wide ($1:5.8$) and wide ($1:7.8$). Twelve pigs were employed bred in the pigstys of Kisber (Hungary) of ages ranging from 4 to 12 weeks and weighing from 11 to 40 lbs. They were divided into groups of three proceeding from the same litter, two of each group being submitted to experiment, the third acting as control. The latter was slaughtered at the beginning of the experiment in order to determine the composition of those parts of the subjects experimented on, which were concerned in the increase of weight.

The organs of the slaughtered animals were divided into 10 to 12 groups, the whole organ being studied except in the case of the muscles, bones, skin and connective and fatty tissues, for which only half the animal was taken. The dry matter, fat, ash, nitrogen, glycogen and calorific value were determined. The results obtained were as follows.

1) The pigs fed on milk having a narrow nutritive ratio put on more flesh but less fat than did those fed on a ration poorer in protein. The ones of the young animals were relatively heavier than those of the older subjects which had been subjected to intensive feeding.

2) Analysis proved that the nitrogen (*i. e.* the dry matter less the fat and ash) is the most constant constituent of the young pig's organism, whilst the fat and ash are the most variable. Age influences the composition, in a sense that the older animals contain less water and more fat and have a higher calorific value than the younger animals.

The nature of the feeding had a marked effect on the composition of young pigs. Thus, compared with milk rich in carbohydrates, milk, rich in increased the content of dry matter, dry matter less fat, dry matter less fat and ash, ash, nitrogen and the calorific value. *Per contra*, it diminished the proportion of water and depressed the ratio of the aforesaid constituents to water.

The composition of young pigs was greatly influenced by the nutritive ratio of their food. The ration having a wide nutritive ratio increased the proportion of dry matter and of fat, and the calorific value.

3) The best criterion of the influence of feeding was afforded by the composition of and increase of live weight during the experiment.

4) The distribution of the nutritive elements and the calorific value the different parts of the organism was as follows:

With the oldest animals, the connective and fatty tissues as well as the muscles contained the greater part of the total dry matter; the other organs the lesser part.

When the milk ration had a wide nutritive ratio the dry matter of the connective tissue was increased at the expense of the muscles.

The effect of food rich in fat was to favour the fixation of dry matter in the bones and muscles when compared with food rich in carbohydrates.

The greater part of the water (about half the total) was found in the

muscles. The brain, bones and muscles of the older animals contained less water than did those of the younger subjects.

Comparing the behaviour of milk rich in carbohydrates with that of milk rich in fat, the latter diminished the fixation of water in the connective tissue and increased it in the muscles.

The total ash was distributed as follows : the bones contained 65.76 per cent. and the muscles about 15 per cent. In comparison with those of young pigs fed on emulsion milk, the bones of animals fed on diafarinised milk contained the least quantity and the muscles the highest quantity of ash.

The muscles contained the greater part (about half the total) of the nitrogen found in the body of the young pig. The fatty and connective tissues contained 36 to 60 per cent. of the chemical energy, the muscles 41 per cent. and the bones 6 to 10 per cent. Milk having a wide nutritive ratio increased the energy reserve of the connective and fatty tissues to marked degree.

5) Analysis of the different organs gave the following results.

The blood of the animals experimented with, particularly of those fed with emulsion milk, contained less dry matter than did the blood of the control animals.

The lungs, heart, glands, bones, skin, connective and fatty tissue muscles and intestines of the older animals contained more dry matter, fat and energy than did the same organs of the younger subjects. Compare with milk rich in carbohydrates milk rich in fat increased the dry matter, the dry matter less fat, the ash, the nitrogen and the calorific value. Milk having a wide nutritive ratio increased the dry matter, the fat, and the calorific value.

The nature of the feeding had a considerable influence on the composition of the bones. Milk rich in fat, as compared with milk rich in carbohydrates, increased the ash content to a very marked extent.

6) The dry matter of the liver contained 0.16 to 0.74 per cent. of glycogen ; that of the muscles 0.4 to 11.6 per cent. from which it is calculated that the liver of the young pig contains 0.53 to 8.72 grms, the muscles 0.7 to 5.91 grms of glycogen.

The writer has estimated the glycogen in the fresh liver and muscles of two young pigs, each weighing 11 lbs. The animal fed on diafarinised milk contained 34.2 grms, that fed on emulsion milk 13.9 grms, the liver and muscles of the first thus containing 2 $\frac{1}{2}$ times as much glycogen as do those of the second. Hence the greater part of the glycogen is probably decomposed during drying.

7) The proportion of fat and carbohydrates in the food are held to be of equal interest to the physiologist and to the practical feeder. It is found that, as compared with food rich in fat, food rich in carbohydrate stimulates an increase of the water content of the organism and has an unfavourable influence on the fixation of dry matter less fat and ash.

The mean results obtained when using two young pigs from the same litter, fed side by side, one on diafarinised milk the other on emulsion milk

aving the same nutritive ratio, showed that the animals responded differently. For an increase in weight of 22 lbs, the animal fed with emulsion milk produced 4.2 lbs of dry matter less fat and 13.8 lbs. of water, whilst that fed with diafarinised milk fixed 17.24 lbs. of water in the organism or the same quantity of dry matter less fat, the excess of water in the latter animal being 3.46 lbs. or 25 per cent. Of this excess 0.94 lbs. belonged to the skin and connective and fatty tissues : 1.1 lbs. to the muscles ; 0.60 lbs. to the bones ; 0.81 lbs. to the other organs ; i. e. the water content of the connective tissue increased 45 per cent ; of the bones 35 per cent ; of the muscles 6 per cent. ; and of the other organs 23 per cent.

The origin of this excess of water must be attributed more especially to the glycogen, for, during the metabolism of the fat the water derived from the glycogen probably remains in the tissues.

¹⁹⁰ - Influence of Feeding Pigs with Spoiled Maize upon the Composition of the Fat. — See this Bulletin No. 1221.

¹⁹¹ - Investigations on the Poisoning of Poultry by Corn Cockle (*Agrostemma Githago*) in Hungary. — DEGEN, A. (Royal Hungarian Seed Testing Station Budapest), in *Kisérletügyi Koálymenyek* (Bulletin of the Hungarian Agricultural Station) Vol. XIX, Part I, pp. 11-21. Budapest January-June 1916.

As great difference of opinion exists among writers (LEPMAN, BOHNER, OTT, HONCAMP, NEUMANN, MÜLLER, KLING, ROBERT, TORMAY, HAGEMANN, HANSEN, MEISSL, etc) as to the toxicity of the siftings of certain cereals, particularly corn cockle (*Agrostemma Githago*) the writer (director of the Royal Hungarian Seed Testing Station) has made a fresh experimental study of the question in the following way. 1) All cases of illness and death of animals fed with food containing siftings of grain were examined minutely; 2) the services of an expert were engaged; 3) feeding trials were made with the supposed toxic substance in conjunction with the Animal Biology and Nutrition Station; 4) Help was sought from the Veterinary High school.

In June 1915, 280 geese perished at Pestszentlorie, through the consumption of a meal, purchased by the breeder as meal No. 8 but really originating from a sifting containing 40 to 50 per cent of the seeds of *Agrostemma githago*. With the same meal the Animal Biology and Nutrition Station undertook feeding trials on three fowls and three geese. During a preliminary period of six days the six animals were fed with maize grain. After this preparatory period one fowl and one goose received at 7.0 a. m. respectively 50 and 100 grms of the meal in question. At about 10 a. m. the two animals exhibited symptoms of poisoning, and died at about noon. The two other fowls received the same meal gradually thus: 1st day: a) 80 ms of maize + 20 grms of meal containing corn cockle; 2nd day: b) 60 ms of maize, 40 grms of the meal; 3rd day: c) 20 grms of maize, 80 grms of the meal. One of the fowls died after having taken ration b), the other after ration c). One of the geese succumbed after a ration of 120 grms of maize, 80 grms of the same meal, whilst the other resisted the meal better because it had rejected the greater part of the ration on three successive

days. In order to prevent vomiting the quantity of water was diminished. From the fourth day the goose received only a ration of 100 grms of the meal and it died on the 6th day. The autopsy of the dead animals performed by the Pathological Department of the Veterinary High School diagnosed for the three geese : inflammation of the aesophagus : serous circumoesophagea inflammation : inflammation of the small intestine : hemorrhage of the visceral membrane of the pericardium. An hemorrhagic inflammation of the stomach was also observed in the three geese, caused by numerous *Stryngylus nodularis*, which developed independently of the absorption of the toxic substance. Of the three fowls two suffered from an acute inflammation of the small intestine and hemorrhage of the pericardium, the third from an acute inflammation of the crop, oesophagus and gizzard.

The following conclusions are drawn.

- 1) The observed cases establish the fact that *Agrostemma Githago* has the property of producing in poultry grave symptoms of poisoning.
- 2) As the meal employed in the experiments contained only 40 to 50 per cent of the grist of corn cockle seeds, it follows that substitution of one fifth of the daily ration by this grist will cause death.
- 3) Since the pathological symptoms mentioned above resemble very closely those of acute mineral poisoning, great caution must be employed in judging analogous cases, particularly as siftings of grain containing more or less corn cockle seed constitute a food widely distributed in Hungary.
- 4) Since the siftings contain widely varying amounts of corncockle seed (from 8 to 38 per cent in the mills of Budapest) the percentage of corn cockle seed admissible in the daily ration must be known in order to avoid poisoning.
- 5) It is convenient to base the daily ration on the maximum content (about 40 per cent) of corncockle seed in the residues from the milling. Nevertheless it is advisable to submit a sample of the product to an Agricultural Station for examination and expert advice.

HORSES

1192 - Experiments on the Feeding of Draught Horses made in Sweden from 1908 to 1915.

— HANSEN, N. (Director of the Domestic Animal Department of the Central Agricultural Station of Stockholm) in *Fühlings landwirtschaftliche Zeitung*, 65th year, No. 13-14, pp. 289-315. Stuttgart, July 1-15, 1916.

In the years 1908-1915 the Swedish Central Agricultural Experiment Station has made repeated experiments to ascertain the value and practical utility of different foods for draught horses. Some of these experiments have already been described by the writer in a preceding publication. The present experiments 40 in number, divided into 12 series, are made with 372 horses, deal with the following foods : barley, oats, a mixture of oats and barley, maize, potatoe flakes, wheat bran, oat bran, a mixed food (oat bran and rice meal), mangels, carrots and cooked potatoes.

In choosing the animals amongst ordinary draught horses on different farms, care was taken that the horses of the same team were as far possible of the same age, temperament, and strength and had the same height to the withers. Except one team, all the off-side horses formed of

experimental group, and all the near-side horses another group. In the experiments exact weights of food were distributed to the different groups.

In some series a preliminary experiment was made to ascertain whether the groups were equivalent, but this was unnecessary in most cases, the equivalence of the groups being known beforehand.

The work done by a horse cannot be exactly determined either in agricultural practice or in practical feeding experiments but it can be assumed to be proportional to the nutritive value of the food administered, which is indicated by the change in the live weight of the animals. Consequently the experimental results should be determined from the variations of the live weight of the horses. In order to obtain satisfactory results by means of weightings, all these should be made at the same time of day.

In some experiments the weighing was made regularly at midday, after feeding and before yoking, in others after the return at midday but before feeding. Sufficiently exact results were thus obtained.

The ration was fixed according to the work to be done, in such a manner as to prevent an emaciation of the animals in a period of heavy work, and an increase of weight in a period of light work.

The following results were given by the different foods.

I. *Barley and oats.* — In some previous experiments with cows the writer using KELLNER's starch value, has estimated the forage value of 100 kgs. of barley at 100 forage units and that of 100 kgs. of oats at 84 units. Thus 1 kg. of barley corresponds with about 1.2 kgs. of oats.

The present experiments (November 1909 to December 1913) were intended to determine whether this ratio is also true for horses. Barley and oats, of a quality a little inferior to the average were given in a ration of 1: 1.2. The daily ration contained on an average 4 kgs. (8.8 lbs.) of barley and 5 kgs. (11 lbs.) of oats. There were five experiments lasting from 49 to 77 days, and there were 3 to 8 animals in each group.

The results show that 1 kg. of barley can easily replace 1.2 kg. of oats in the feeding of draught horses. Barley did not prove an unsuitable food for horses, neither did it diminish their working power.

II. *Oats and wheat bran.* — Experiments have shown (in accordance with KELLNER's observations) that wheat bran is of little value for fattening pigs but an excellent food for milk production.

The writer's experiments were made to determine whether bran had the same effect on horses as on cows, or as on pigs. For this purpose it was considered opportune to compare it with oats. On an average 2.56 gs. (5.6 lbs.) of oats or 2.78 kgs. (6.1 lbs.) of bran were given. The oats ration contained 2.15 and the bran ration 2.21 forage units. Six experiments were made lasting 28 to 69 days, and there were three to eight animals in each group.

The wheat bran, which is richer in forage units, also produced a rather greater increase in the live weight of the animals, from which the conclusion is drawn that the action of bran on horses is similar to that on cows.

III. *Oats and maize.* — The forage values of oats and maize were to be compared, and for this purpose they were employed in the ratio of

1.2 : 1.0. The oats were of excellent quality, but the maize scarcely up to the average. 3.67 forage units of maize were replaced by 3.75 units of oats. The maize ration contained on an average 3.6 kgs. (7.9 lbs.) and the oats ration 4.3 kgs. (9.5 lbs.) per head per day. There were six horses and two experiments lasting 49 to 77 days.

From the results it is concluded that if the maize ration does not exceed 50 per cent of the total ration of concentrated food, and if the maize is finely ground before being given to the horses its forage value is 20 per cent higher than that of oats. Thus oats can be replaced by maize in the proportion of 1.2 : 1.0.

IV. *Oat bran and a mixture of oats and barley.* — From the oat mills of Sweden a bran is obtained which before the War was largely exported. Export now being forbidden, this has to be utilised in the country, and it is of interest to learn its forage value. Previous experiments made with cows proved that 1 kg. of oats bran is equivalent to 1 forage unit.

The writer's experiments were intended to determine whether this bran is as valuable for horses as for cows. A mixture of barley and oats was employed as a standard of comparison. The four experiments lasted 55 to 90 days each and were made on 17 horses each receiving up to 3 kg. (6.6 lbs.) of oat bran per day. The experiments showed that when 1 kg. (2.2 lbs.) of the mixture was replaced by 1.42 kgs. (3.1 lbs.) of bran, the latter did not give the expected result, but if the ratio was smaller a better result was obtained. For the group fed with oat bran a better mean experimental result was obtained than for the group fed with the mixture, and it may be concluded that in practice 1.8 kg. (4 lbs.) of oat bran is equivalent to 1 forage unit. Oat bran is not a better food for horses than for cows. Not more than 4 kgs. (8.8 lbs.) per head per day should be given.

V. *Mixture of barley and oats, and the mixed food "Gota".* — The low forage value of oat bran together with its high content of raw cellulose have induced the manufacturers to improve its quality by the addition of rice meal. This mixed food (60 per cent oat bran and 40 per cent rice meal) This is sold in Sweden under the name of "Gota". Feeding experiments made with cows and pigs have shown that 1.5 kgs. (3.3 lbs.) of Gota is almost equivalent to 1 kg. (2.2 lbs.) of barley or 1.1 kgs. (2.4 lbs.) of the mixture of oats and barley.

In the experiments with horses 1.5 kgs. (3.3 lbs.) of Gota were replaced by 1.1 kgs. (2.4 lbs.) of the mixture of barley and oats. Two experiments were made lasting from 82 to 84 days; eight horses were employed to which a ration of 3.85 kgs. (8.5 lbs.) of Gota was given per head per day.

Somewhat the better results were obtained with the group which had been fed with Gota, but in general the two forages can be described as equivalent. According to the writer, Gota is an excellent food for horses, but it must be of good quality and must not contain more than 16 per cent of raw cellulose.

VI. *Barley and potato flakes.* — The experiment was made to determine the forage value of these two materials for horses. Two kgs. (4.4 lbs.) of barley were first replaced with 2 kgs. (4.4 lbs.) of flakes, then with 2.5 kgs.

(5.5 lbs.). Two experiments were made lasting 78 and 43 days, and the total number of horses employed was nine.

The final result was in favour of the potato flakes, and it is concluded that for feeding horses 1 kg. (2.2 lbs.) of flakes containing 980 grms. (1.9 lbs.) of dry matter will easily replace 1 kg. of ordinary barley.

VII. *Barley and cooked potatoes.* — The writer has shown experimentally that in the fattening of pigs 1 kg. (2.2 lbs) of ordinary barley can be replaced by 0.9 kg. (2 lbs.) of the dry matter of cooked potatoes.

In the experiment with horses the two forages were given in the above proportion. The potatoes were cooked every three days and at least four rations of them were given daily. Except in one case all the eight horses ate these rations willingly. Two experiments were made lasting 71 to 80 days, and the daily ration contained 2 to 3 kgs. (4.4 to 6.6 lbs.) of dry matter.

The two groups gave the same result. Accordingly the conclusion is drawn that in the feeding of horses a ration of 900 grms. (2 lbs.) of the dry matter of potatoes has the same forage value as 1 kg. (2.2 lb.) of barley.

VIII. *Mixture of oats and barley and mangels.* — This mixture was replaced partly by mangels and partly by carrots in the proportion 1 kg. mixture : 1 kg. dry matter of the roots 8 to 20 kgs. (17.6 to 44 lbs.) of roots were fed per head per day. Four experiments were made with 17 horses, lasting 50 to 89 days.

The experiments proved that well cleaned roots can be given at the rate of 20 kgs (44 lbs) per head per day without injury to the horses. 1 kg (2.2 lbs.) of the dry matter of the roots has the same nutritive value as 1 kg. (2.2 lbs.) of the mixture.

The experiments were intended also to discover the quantity of food required by horses. The quantity of forage administered was determined daily, and then from measurements of the live weight of the horse, it was determined whether the ration was suitable for the work to be done. The nutritive value of the different rations was expressed in forage units. In addition the content of digestible protein in each ration was determined.

The results show that the number of forage units and the necessary quantity of digestible protein vary according to the work done by the horses. All the experiments have proved however that the ration is completely utilised if it contains 75 to 80 grms of digestible protein per forage unit. This, the writer terms "the minimum requirement" of digestible protein.

Based on these observations the following relative figures have been established for horses weighing about 600 kgs. (12 cwt.).

Kind of work done by the horses	Number of forage units required	Quantity of digestible protein required
Light	7 to 8	500 to 600 gms.
Medium	8 to 10	600 to 800 gms.
Heavy	10 to 12	800 to 1000 gms.
Very heavy,	more than 12	more than 1000 gms.

CATTLE

1193 — Score for Holstein-Friesian Bulls and Cows Adopted by the Holstein-Friesian Association of America. — BENNET, E. G., in *Missouri State, Board of Agriculture, Monthly Bulletin*, Vol. XIII, No. 11, pp. 57-61, Columbia Mo. November 1915.

The Holstein-Friesian Association of America (1) has adopted the following scale of points for the score of Holstein-Friesian Bulls and cows:

SCORE FOR HOLSTEIN-FRIESIAN BULL.

(The text under each heading relates entirely to the method of application agreed upon by the Inspectors in order to secure uniformity of work. The abbreviations are as follows: vs, very slight; s, slight; m, marked; vm, very marked; e, extreme).

Contd.

HEAD. — Showing full vigor; elegant in contour	<i>Discredit: vs 1/8 — s 1/4 — m 1/2, — vs 3/4 — e 1.</i>
FOREHEAD. — Broad under the eyes; dishing	<i>Discredit: vs 1/8 — s 1/4 — m 1/2 — vm 3/4 — e 1.</i>
FACE. — Of medium length; clean and trim, especially under the eyes; the bridge of the nose straight	<i>Discredit: s 1/8 — m 1/4 — e 1/2.</i>
MUZZLE. — Broad with strong lips	<i>Discredit: s 1/8 — m 1/4 — e 1/2.</i>
EARS. — Of medium size; of fine texture; the hair plentiful and soft; the secretions oily and abundant	<i>Discredit: m 1/8 — e 1/4.</i>
EYES. — Large; full; mild; bright	<i>Discredit: s 1/8 — m 1/4 — e 1/2.</i>
HORNS. — Short; of medium size at base; gradually diminishing towards tips; oval; inclining forward; moderately curved inward; of fine texture; in appearance waxy	<i>Discredit: m 1/8 — e 1/4.</i>
NECK. — Long; finely crested (if the animal is mature); fine and clean at juncture with the head; nearly free from dewlap; strongly and smoothly joined to shoulders	<i>Discredit: vs 1/8 — s 1/4 — m 1/2 — vm 3/4 — e 1.</i>
SHOULDERS. — Of medium height; of medium thickness, and smoothly rounded at tops; broad and full at sides; smooth over front	<i>Discredit: vs 1/2 — s 1/4 — m 1/2 — vm 2/4 — e 1.</i>
CHEST. — Deep and low; well filled and smooth in the brisket; broad between the forearms; full in the foreflanks (or through at the heart)	<i>Discredit: vs 1/4 — s 1/2 — m 1 — vm 1 1/2 — e 2.</i>
CROPS. — Comparatively full; nearly level with the shoulders	<i>Discredit: vs 1/4 — s 1/2 — m 1 — vm 1 1/2 — e 2.</i>
CHINE. — Strong; straight, broadly developed, with open vertebrae.	<i>Discredit: vs 1/8 — s 1/4 — m 1/2 — vm 3/4 — e 1.</i>
BARREL. — Long; well rounded; with large abdomen; strongly and trimly held up	<i>Discredit: vs 1/4 — s 1/2 — m 1 — vm 1 1/2 — e 2.</i>
LOIN AND HIPS. — Broad; level or nearly level between hook-bones; level and strong laterally; spreading out from the chine broadly and nearly level; the hook-bones fairly prominent	<i>Discredit: vs 1/8 — s 1/4 — m 1/2 — vm 3/4 — e 1.</i>

(1) Gardner M. H. Superintendent, Delavan, Wisconsin.

Contents

JMP. — Long; broad; high; nearly level laterally; comparatively full above the	
thurl; carried out straight to dropping of tail.	7
<i>Discredit: vs 1/8 — s 1/4 — m 1/2 — sm 3/4 — e 1.</i>	
JURL. — High; broad	4
<i>Discredit: vs 1/4 — s 1/4 — m 1 — vm 1 1/2 — e 2.</i>	
JARTENS. — Deep; broad; straight behind; wide and full at sides; open in the	
twist	5
<i>Discredit: vs 1/8 — s 1/2 — vm 3/4 — e 1.</i>	
ANKS. — Deep; full	2
<i>Discredit: us 1/8; s 1/4; m 1/2; vm 3/4; e 1.</i>	
BS. — Comparatively short; clear and nearly straight; wide apart; firmly and	
squarely set under the body; arms wide, strong and tapering; feet of me-	
dium size, round, solid and deep	5
<i>Discredit: us 1/8 — s 1/4 — m 1/2 — vm 3/4 — e 1.</i>	
HL — Large at base, the setting well back; tapering finely to switch; the end of	
bone reaching to hocks or below; the switch full	2
<i>Discredit: s 1/8 — m 1/4 — e 1/2.</i>	
HAIR AND HANDLING. — Hair healthy in appearance; fine, soft and furry; skin of	
of medium thickness and loose; mellow under the hand; the secretions	
oily, abundant and of a rich brown or yellow color	10
<i>Discredit: us 1/4 — s 1/2 — m 1 — vm 1 1/2 — e 2.</i>	
ADINARY VEINS. — Large; full; entering large orifices; double extension; with	
special development, such as forks, branches, connections, etc	10
<i>Discredit: us 1/4 — s 1/2 — m 1 — vm 1 1/2 — e 2.</i>	
DIMENTARY TEATS. — Large, well placed	2
<i>Discredit: vs 1/8 — s 1/4 — m 1/2 — vm 3/4 — e 1.</i>	
MITCHON. — Largest; finest	2
<i>Discredit: vs 1/2 — s 1 — m 2 — vm 3 — e 4.</i>	
GENERAL VIGOR. — For deficiency Inspectors shall discredit from the total receiv-	
ed not to exceed eight points.	
<i>Discredit: vs 1 — s 2 — m 3 — vm 5 — e 8.</i>	
GENERAL SYMMETRY AND FINENESS. — For deficiency Inspectors shall discredit	
from the total received not to exceed eight points	
<i>Discredit: vs 1 — s 2 — m 3 — vm 5 — e 8.</i>	
GENERAL STYLE AND BEARING. — For deficiency Inspectors shall discredit from	
the total received not to exceed eight points.	
<i>Discredit: vs 1 — s 2 — m 3 — vm 5 — e 8.</i>	
CREDITS FOR OFFSPRING. — A bull shall be credited one point in excess of what he	
is otherwise entitled to, for each and every animal of which he is sire ac-	
tually entered in the Advanced Register, not to exceed ten in number	
1 scaling for the Advanced Register, defects caused solely by age, or by accident,	
or by disease not hereditary, shall not be considered. But in scaling for the	
show ring, such defects shall be considered and duly discredited	
bull that in the judgment of the Inspector will not reach, at full age and in good	
flesh, 1,800 lbs., live weight, shall be disqualified for entry in the Advanced	
Register	
10 bull shall be received to the Advanced Register, that with all credits due him,	
will not scale, in the judgment of the Inspector, at least 80 points.	
Perfection	100
Total discredit
Net score

* Not now in use by Advanced Register, but of great value as an aid in judging cattle.

SCORE FOR HOLSTEIN-FRIESIAN COW.

(The interlines relate entirely to the method of application agreed upon by the Inspectors in order to secure uniformity of work. The abbreviations are as follows: vs, very, slight; s, slight; m, marked; vm, very marked; e extreme.)

Contents

HEAD. — Decidedly feminine in appearance; fine in contour	<i>Discredit: vs 1/8 — s 1/4 — m 1/2 — vm 3/4 — e 1.</i>
FOREHEAD. — Broad between the eyes; dishing	<i>Discredit: vs 1/8 — s 1/4 — m 1/2 — vm 3/4 — e 1.</i>
FACE. — Of medium length; clean and trim especially under the eyes, showing facial veins; the bridge of the nose straight	<i>Discredit: s 1/8 — m 1/4 — e 1/2.</i>
MUZZLE. — Broad with strong lips.	<i>Discredit: s 1/8 — m 1/4 — e 1/2.</i>
EARS. — Of medium size; of fine texture; the hair plentiful and soft; the secretions oily and abundant	<i>Discredit: m 1/8 — e 1/4.</i>
EYES. — Large; full; mild; bright.	<i>Discredit: s 1/8 — m 1/4 — e 1/2.</i>
HORNS. — Small; tapering finely towards the tips; set moderately narrow at base; oval; inclining forward; well bent inward; of fine texture; in appearance waxy	<i>Discredit: m 1/8 — e 1/4.</i>
NECK. — Long; fine and clean at juncture with the head; free from dewlap; evenly and smoothly joined to shoulders	<i>Discredit: vs 1/8 — s 1/4 — m 1/2 — vm 3/4 — e 1.</i>
SHOULDERS. — Slightly lower than the hips; fine and even over tops; moderately broad and full at sides	<i>Discredit: vs 1/8 — s 1/4 — m 1/2 — vm 3/4 — e 1.</i>
CHEST. — Of moderate depth and lowness; smooth and moderately full in the brisket; full in the foreflanks (or through the heart).	<i>Discredit: vs 1/4 — s 1/2 — m 1 — vm 1 1/2 — e 2.</i>
CROPS. — Moderately full	<i>Discredit: vs 1/4 — s 1/2 — m 3/4 — vm 1 1/2 — e 2.</i>
CHINE. — Straight; strong; broadly developed, with open vertebrae	<i>Discredit: vs 1/8 — s 1/4 — m 1/2 — vm 3/4 — e 1.</i>
BARREL. — Long; of wedge shape; well rounded; with a large abdomen, trimly held up (in judging the last item age must be considered)	<i>Discredit: vs 1/8 — s 1/4 — m 1/2 — vm 3/4 — e 1.</i>
LOIN AND HIPS. — Broad; level or nearly level between the hook-bones; level and strong laterally; spreading from chine broadly and nearly level; hook-bones fairly prominent	<i>Discredit: vs 1/8 — s 1/4 — m 1/2 — vm 3/4 — e 1.</i>
RUMP. — Long; high; broad with roomy pelvis; nearly level laterally; comparatively full above the thurl; carried out straight to dropping of tail	<i>Discredit: vs 1/8 — s 1/4 — m 1/2 — vm 3/4 — e 1.</i>
THURL. — High; broad	<i>Discredit: vs 1/4 — s 1/2 — m 1 — vm 1 1/2 — e 2.</i>
QUARTERS. — Deep; straight behind; twist filled with development of udder; wide and moderately full at the sides	<i>Discredit: rs 1/8 — s 1/4 — m 1/2 — vm 3/4 — e 1.</i>

Contents

BLANKS.—Deep; comparatively full	2
<i>Discredit: vs 1/8 — s 1/4 — m 1/2 — vm 3/4 — e 1.</i>	
LESS.—Comparatively short; clean and nearly straight; wide apart; firmly and squarely set under the body; feet of medium size, round, solid and deep	4
<i>Discredit: vs 1/8 — s 1/4 — m 1/2 — vm 3/4 — e 1.</i>	
TAIL.—Large at base, the setting well back; tapering finely to switch the end of the bone reaching the hocks or below; the switch full	2
<i>Discredit: s 1/8 — m 1/4 — e 1/2.</i>	
HAIR AND HANDLING.—Hair healthful in appearance; fine, soft and furry; the skin of medium thickness and loose; mellow under the hand; the secretions oily, abundant and of rich brown or yellow colour	82
<i>Discredit: so 1/4 — s 1/2 — m 1 — vm 1 1/2 — e 2.</i>	
MILKY VEINS.—Very large; very crooked (age must be taken into consideration in judging of size and crookedness); entering very large or numerous orifices; double extension; with special developments, such as branches, connections, etc.	10
<i>Discredit: vs 1/4 — s 1/2 — m 1 — vm 1 1/2 — e 2.</i>	
UDDER.—Very capacious; very flexible; quarters even; nearly filling the space in the rear below the twist, extending well forward in the front; broad and well held up	12
<i>Discredit: vs 1/4 — s 1/2 — m 1 — vm 1 1/2 — e 2.</i>	
TEATS.—Well formed; wide apart, plumb and of convenient size	2
<i>Discredit: vs 1/4 — s 1/2 — m 1 — vm 1 1/2 — e 2.</i>	
SCUTCHION.—Largest; finest	2
<i>Discredit: vs 1/2 — s 1 — m 2 — vm 3 — e 4.</i>	
*GENERAL VIGOR.—For deficiency Inspector shall discredit from the total received not to exceed eight points.	
<i>Discredit: vs 1 — s 2 — m 3 — vm 5 — e 8.</i>	
*GENERAL SYMMETRY AND FINENESS.—For deficiency Inspector shall discredit from the total received not to exceed eight points.	
<i>Discredit: vs 1 — s 2 — m 3 — vm 5 — e 9.</i>	
GENERAL STYLE AND BEARING.—For deficiency Inspectors shall discredit from the total received not to exceed eight points.	
<i>Discredit: vs 1 — s 2 — vm 3 — m 5 — e 8.</i>	
Credits for Excess of Requirement in Production.—A cow shall be credited one point in excess of what she is otherwise entitled to, for each and every eight per cent that her milk or butter record exceeds the minimum requirement. In scaling for the Advanced Register, defects cause solely by age, or by accident or by disease not hereditary, shall not be considered. But in scaling for the show ring, such defects shall be considered and duly discredited.	
A cow that in the judgment of the Inspector will not reach at full age, in milking condition and ordinary flesh, 1,000 lbs weight, shall be disqualified for entry in the Advanced Register.	
*No cow shall be received to the Advanced Register that, with all credits due her, will not scale, in the judgment of the Inspector, at least 75 points. (See in last paragraph of Rule VI an exception to these requirements.).	
Perfection	100
Total discredit
Net score

* Not now in use by Advanced Register, but of great value as an aid in judging cattle.

1194 - Score Cards for Simmenthal Cattle. — See this *Bulletin*, No. 1158.

1195 - Establishment of a Herd-Book for the Caracu Breed of Brazil. — *A Estancia*, 4th Year, No. 5, pp. 147-149. Porto Alegre, May 1916.

A society has been founded for the Brazilian Caracu Cattle (1) in the State of São-Paulo, Brazil, under the patronage of the Ministry of Agriculture. It is open to all breeders living in the State of São-Paulo.

In the Caracu Herd-Book can be entered.

1) Pure bred animals, intended for breeding, belonging to a member, and having been passed by the Committee of Registration.

2) Offspring of parents already entered.

Such animals are registered only provisionally. They will be definitely entered only they have reached the prescribed age and then only after a fresh examination.

The registrations are free. The Commission of Registration nominated by the Society, will visit the farms of members twice a year in order to examine pure bred animals for registration in the Caracu Herd-Book. The Commission is composed of two live-stock experts of the Ministry of Agriculture, an official veterinary surgeon and three practical breeders elected from amongst the members.

Members must communicate the birth of calves from pedigree animal not more than two months after calving; when pedigree animals change hands the names of buyer and seller must be given. The death of registered animals must be notified.

For every registered animal a certified pedigree may be obtained signed by the president and secretary of the Society and endorsed by the Ministry of Agriculture of the State of São-Paulo. All the animals definitely registered in the Caracu Herd-Book must bear the mark of the Society and their respective numbers.

A revised edition of the herd-book will be published every year by the Society.

1196 - Dairying on the River Murray Areas. — LANE, G., in *The Journal of Agriculture of South Australia*, Vol. XIX, No. 12, pp. 1043-1046. Adelaide, July 1916.

In a paper read before the Conference of River Murray Branches of the Agricultural Bureau on the development of milk production in the arid and irrigated parts of this region, the writer deals fully with the problem of the production of forage in the summer months and emphasises the importance of ensilage in the feeding of dairy cattle.

According to the writer it is only by the preservation of forage in the silo that milk production can be successfully undertaken on farms deprived of irrigation. Otherwise the advantages to be obtained during the period of the year when green forage is available are nullified by the losses to which agriculture is exposed in the dry months, when the production of forage is impossible without irrigation. Milk production in areas which are semi-arid or where the rains are irregular, must henceforward be considered as closely

(1) See R. October 1916, No. 1093.

nnected with the ensilage of the forage, and the silo would lend a strong support and a factor of success to cattle and sheep breeding in these areas.

The overhead silo, cylindrical and built of stone or lime-concrete gives the best results. Maize and sorghum are the silage crops most employed; at oats, barley and wheat also give good results, if care is taken to ensile them as soon as they are reaped at the beginning of the ripening of the grain. The good results obtained with the Jersey breed of cows is described, and the crossing of typical milking strain Jersey bulls with Ayrshire and northern cows is recommended. The average production of the writer's herd was well over 6,300 lbs. of milk per cow for eight months. The writer does not consider that machine milking has sufficient advantage over hand milking to give it the preference. It is a mistake to give calves skim milk too soon. When the mother's milk is discontinued the calf should receive at first half ordinary and half separated milk. To ensure success either in milk or butter selling, the animal heat should be got out of the fluid at the earliest possible moment.

19 - Mendelism of Short Ears in Sheep. — RITZMAN E. G., in *Journal of Agricultural Research*, Vol. VI, No. 20, pp. 797-798. Washington, D. C., August 14, 1916.

SHEEP

The ordinary ear lengths of the various breeds of sheep approximate closely to 10 cm. (4 inches) or a little over. On the other hand the best of the "short ears" so far observed in a mature animal measure m. ($2\frac{3}{4}$ inches), and they are somewhat thicker than ordinary type ear. The transmissibility of this feature has been studied by the writer at the New Hampshire Agricultural Experiment Station, United States, the case of one native ewe and her progeny, which number 15 head, and by Dr C. B. DAVENPORT of the Station for Experimental Evolution, the Carnegie Institute, who bred two short ear animals supplied by the writer.

The results show in a uniform and concordant way that the "short ear" trait constitutes a simple Mendelism unit factor.

- The Travelling of Flocks in the Dinaric Zone (Eastern Adriatic). — DEDIJER J., in *Annales de Géographie*, Year XXV, No. 137, pp. 347-365. Paris, September 15, 1916.

The annual travelling of flocks and herds to upland summer grazing is distinct from other forms of pastoral migrations such as is practised by nomads of the steppes. Travelling shepherds unlike the nomads are less attached to the soil, not only in their lowland villages but also in the mountain pastures which they visit periodically. This summer migration is its true home in the Mediterranean region for besides being usual amongst the primitive peoples of the Caucasus, Asia Minor and North Africa, it is practised by the most highly civilized European nations, and is standing proof that analogous geographical factors entail analogous social developments. Working from Belgrade, the writer has spent several years studying the migrations in the mountain system running down the western side of the Adriatic in order to determine how far the custom is modified by the physical character of the surface.

Three forms of pastoral life are distinguished: 1) the travelling flocks

of the coast ; 2) the non-migrating flocks of the Mid-dinaric zone, and 3) the migrating flocks of the Pannonian Plain. These three groups correspond to the three divisions of the region brought about by the position of the mountain range which runs from north west to south east. On the Adriatic side the country shows all the signs of the Mediterranean influence in climate, flora and fauna ; but on the Pannonian Plain which is on the northern and north eastern side of the ridge, the climate, flora and fauna of Central Europe prevail. Between these two zones lies the region of high mountains where conditions of life have arisen somewhat similar to those found in Alpine regions.

I. *The travelling of flocks in the Adriatic zone.* — Between the coast and the watershed 3 regions are distinguished : 1) the low region, reaching up to 800 to 2500 ft. in its highest parts, occupied by the villages of people who undertake the summer migrations, 2) the intermediate zone where stock raising is practised without migrations ; 3) the zone of summer pastures on the high mountains, occupied intermittently. Migrations begin early in June. In the low region the drought is severe and the population labour incessantly to increase the water supply. With infinite trouble they reclaim and cultivate small isolated pieces of land, going so far in some places as to gather manure in the village streets to place in the crevices of rocks and then planting vines therein. In other places they build walls across the dry beds of torrents so that in the rainy season a sediment should be deposited ; by persevering for 30 years, one man has obtained a field yielding 2 tons of maize by such means.

Where a suitable hill adjoins the village, lambing stations are established at altitudes of 1500 to 2500 ft. to which the flocks are brought from the high mountain for the winter season, but if there is no convenient hill of that kind then the flocks are brought right down to the village. Where the neighbouring foothills reach an altitude of over 4000 ft. then the flocks do not need to migrate to the high mountains for summer pasture.

In the region of Duvno (western Herzegovina) the migrations depend on the water table. During exceptional droughts, it may occur that sheep herds who have returned home from the high mountain in early autumn have to take their flocks back to higher altitudes for water. On some routes such as those from the arid Karst region, there are regular halting places where the shepherds remain for some time.

A more primitive form of migration exists in some parts where the entire population leaves the villages for six months of the year and accompanies the flocks to the high mountains. In other parts where the land is more fertile, tillage has largely replaced stock raising and migrations have been abandoned on account of the small size of the flocks.

II. *The non-migrating flocks of the Mid-dinaric zone.* — This zone consists of a high region (above 2300 ft. on the Adriatic side) where the rainfall is well distributed throughout the year and the summer heat never excessive. Local migrations only take place from the deep river valleys where even in those altitudes are unbearably hot in summer. Being very narrow the cultivated surface is very restricted and further it is planted in

ees, so that the summer pasturing of livestock is a difficult matter. The yards are consequently sent to the neighbouring mountain sides.

III. *The migrating flocks of the Pannonian zone.* — On the north eastern de of the ridge the migrations are in the opposite direction, *i. e.* from ountain villages to lowland pastures, and take place twice a year, in auumn and in spring. Whereas the migrations on the Adriatic side are undertaken on account of heat and drought, the flocks on the Pannonian side e driven to the mountains by snow and excessive cold. In the autumn, icks of 800 to 1000 sheep come down to the plain for pasture and when e first snow occurs return to the mountain where they winter in barns. en in spring they come down again for what is known as the " lambing igration ".

99 - A Model Poultry Farm in Uruguay. — *El Estanciero*, 6th Year No. 137, pp. 9-11.
Montevideo, June 15, 1916.

POULTRY

The most important poultry farm in Uruguay is situated close to the ion of Toledo. It was established in 1913 by the Government with a tal head of 350 birds, comprising 200 Leghorn fowls obtained from the ed States, 100 Prat Catalonians of Spanish origin, groups of three fowls ch of the breeds White Plymouth Rock, Bastard Plymouth Rock, Buff pington, Faverolles Wyandotte (simple comb and rose comb), and Mi- rea, and 20 ducks of the Pekin breed.

In 1915 the farm produced 39 877 eggs. Of these 6240 were given to mers for breeding, 8000 were sold for consumption and the farm set the mainer obtaining 9873 chickens and 200 ducklings of the Pekin breed. the same year 5000 fowls were sold. A head of 300 fowls and 300 cks now maintained on the farm.

The farm is provided with the most up to date plant. It can breed 20 chickens per annum and its 20 incubators have a capacity of 4800 eggs. chickens are kept shut up for one month; they are then transferred a special rearing house, and from there to large enclosures. By far the gest proportion though are sold immediately they are hatched. In order avoid all possibility of contagion, water is distributed from a tank to all souses and poultry houses in such a way that no two chickens can drink m the same place. A 5 HP oil engine is used for a pump and for driving other mechanical devices required by the farm.

The administration of the farm is entrusted to a manager and an ass- ant who work under general directions from a committee.

o - The " Ideal " Crespi-Balbi Hive. — *L'Agricoltore moderno*, Year III, No. 8, pp. 131- 133. Turin, August 1916.

BEE-KEEPING

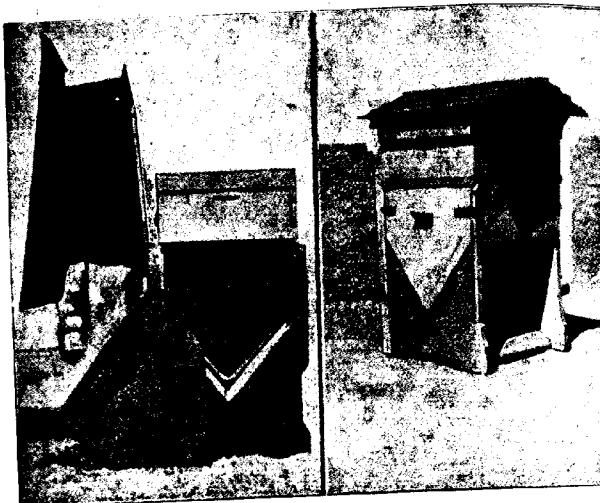
The International Museum of Agriculture at Turin has received and tested on a new hive, the " Ideal ", sent by its inventor Mr C. CRESPI- LLI of Busto Arsizio (Italy). It is an improvement on the type originally introduced by Pettitt in England and by Tonelli in Italy, and combines good qualities of the American and German hives.

In the Pettitt-Tonelli type the moveable frames have curved sides ile in the new type the sides are straight and in the form of a pentagon.

Two very fine wires which also serve to attach the comb foundations bind each frame together with great rigidity. Though the frames are placed longitudinally in the hive draughts are prevented by having the entrance at the bottom and right in the middle. The frame of the supers is only 5 in high, the better to prevent the queen from going up into it.

When it is required to examine the hive, the top may be lifted off the weather be warm enough, otherwise one or other of the side walls may be removed. By this means only half the sections are uncovered at any one moment and for a much shorter time than is possible with the German

The "Ideal" CRESPI-BALBI hive.



In sections

Ready for use.

hives. For casual examinations the mirror placed in the rear wall is useful. When necessary the bees may be fed through a hole in the front wall.

The walls of the hive are nearly $1\frac{1}{4}$ in. thick and give ample protection against temperature changes; it has been shown in Lombardy that increase in yield obtained in hives with cavity walls is not sufficient to compensate for the increased cost of the hive.

A new feeder has also been put on the market by Mr Crespi-Balbi. It is a combination of the Guzzi type with Root's "Simplex".

1201 - Ontario Beekeepers Association Honey Crop Report for 1916 in *The Canadian Horticulturist and Beekeeper*, Vol. 24, No. 9, p. 225. Peterboro, Ont. September 1916.

The White Honey Crop in 50 counties of Ontario, in 1916, according to the Ontario Beekeepers' Association, was 2127 903 pounds, from 23 763 colonies (spring count) with an average of 89.6 pounds per colony. The honey crop in 1915 was 1 175 871 pounds from 20 402 colonies.

1202 - The Work of the Institute for Research on Silkworms at Portici (Italy). — Acqua C., *Rendiconti dell'Istituto bolognese della R. Scuola superiore di Agricoltura in Portici*, Vol. I, pp. 1-98. Portici, 1916.

SERICULTURE

I. Experiments on the digestion of silkworms. — In order to investigate the digestibility of proteins, fats and carbohydrates by silkworms a quantity of intestinal juice was extracted from worms under normal conditions of rearing and its effect on the various substances was studied *in vitro*. The presence of an active protease was proved. This ferment works in an alkaline medium and must be considered of the nature of a trypsin, acting on blood fibrin and on egg albumen either in the liquid or coagulated form. Starch and fats were untouched and this was confirmed by microchemical tests carried out on pieces of ingested mulberry leaf which were removed from various parts of the intestinal tract. On the other hand, as soluble sugars which are contained in considerable quantities by the leaf were digested, the starch in the leaf must be absorbed indirectly. The cell membranes of ingested leaves remained absolutely unaltered, so that absorption of protein substances from the cytoplasm could only take place after the rupture of the cell walls. With regard to the chlorophyll, it would seem certain that where the tissue was disintegrated the pigment contained in the chloroleucites was absorbed, but where the chloroleucites remained enclosed inside the cells, the pigment remained unaltered. This fact was confirmed by a spectroscopic test. The secretions from the anterior and middle portions of the intestine were precisely similar in their effect, but the secretion from the posterior part of the intestinal tract was absolutely inactive.

II. Phototaxis in silkworms (1).

III. Experiments on the absorption of glucose by stems and leaves of mulberry trees. — In a previous paper (2) a description has already been given of the methods adopted for obtaining the absorption of liquids by the aerial parts of plants. It consists in cutting through the petioles near the blade of the leaf or cutting the tips of young shoots and placing the cut surfaces in the solution to be tried. The method was applied to *Morus alba*, using a solution of 5 per cent glucose for the cut ends of young shoots or a solution of 6 to 10 per cent applied in a glass tube to a wound made in the trunk of the tree. Where the experimental plants were very young, the glucose absorbed had a very marked effect : growth was increased ; the shoots were longer and thinner and much less rigid so that they required support ; the leaves were larger and thinner showing a considerable reduction of the palisade and spongy tissues. With the medium-sized plants the growth was

(1) See R. March 1916, No. 328.

(Ed.)

(2) *Rendiconti dell'Accademia dei Lincei*, Vol. XXIII, 1913.

still affected but to a less degree and with adult trees, the differences obtained were very small. A microscopic examination revealed equal quantities of starch in the leaves of the test plants and of the control plants, and Fehling solution showed no accumulation of glucose in the treated leaves, so that it may be concluded that the absorbed solution was used up in the development of the plant.

IV. *An electric bell for giving warning of changes of temperature during incubation.* — The writer has invented a new instrument to ensure a constant temperature during incubation. It is sensitive to half a degree C., is simple and inexpensive, and may be obtained from CAROSI, Rome for 2 lire.

V. *Autumn rearing of silkworms.* — Autumn rearing as a whole has not proved a success chiefly owing to the imperfect preparation of the *graine*. The stripping of mulberry trees in autumn, if properly carried out need entail none but the very slightest injury to the trees, and where the trees are abundant the supply of leaves should offer no difficulty.

Some of the methods of obtaining *graine* for autumn hatching aim to be condemned, i. e. the use of eggs from the previous season or from a very early spring hatching after storage at low temperature during the summer. Other methods yield worms of doubtful vigour, as for instance the Quajat method where the *graine* is prepared in October, estivates during the winter, and hibernates during the summer. Occasionally the use of retarded eggs has been recommended before they have been tested roughly under practical conditions (e. g. the retardation of spring eggs by means of electricity, acids, etc.). The best method is undoubtedly that of Dr CRIVELLI; it is known as the «embryostatic» method, and has given excellent results in practice over a number of years. Details of the management have been kept secret, but in general outline they must resemble that of MARTINI (given below) as both yield identical results.

Management of silkworms under the Martini system.

Temperature at which
silkworms must be maintained
°C.

<i>Period of estivation:</i>	
From laying time to end of August	22 to 27
During September	20 " 22
" October	17 " 20
From November to end of February	16 " 17
" March 1 to 20	8 " 10
<i>Period of hibernation:</i>	
From March 20 to July 30	2 " 3
" August 1 to about August 15 when incubation begins . . .	gradual rise

The writer states that 20 years ago he had the opportunity of seeing some extensive rearings carried out with *graine* supplied by Dr Crivelli and even tested the eggs himself. In every case most satisfactory results were obtained. Autumn rearing had become popularized to the point of being a matter of current practice in parts of Central Italy, but with the spread

the practice, the sale of unreliable *graine* became common and led finally to a season of complete and general failure after which autumn rearing fell to disrepute and was abandoned.

133 - **The Work of the Experiment Station for Silk Worms at Murcia, Spain, 1910 to 1914.** — VIRGILI A., in *Ministerio de Fomento, Dirección general de Agricultura, Minas y Montes, Estación sericola de Murcia, Memoria descriptiva de los principales trabajos realizados y resultados obtenidos desde 1º de Diciembre de 1910 hasta el 15 Enero de 1914, traslado de la estación y aplicación de los servicios*, pp. 1-100. Murcia, 1915.

1) *Variety Trials.* During the three years 1911 to 1913, 210 gms. *graine* was obtained from Italy, France, Japan, China and other Spanish provinces and tested at Murcia; the more suitable varieties were then selected and acclimatised for subsequent distribution to rearers. Some alien varieties proved particularly successful, being heavier yielders than the native varieties and producing a silk which finds a ready market both in Spain and at Marseilles. They have not, however, reached a stage of distribution as they are not yet fully acclimatised.

2) *Incubation of graine for rearers; inspection of home incubation.* — A new State service was instituted 1913 to revise and bring up to date the old fashioned systems of incubation practised in the district. A new incubator of 120 oz. capacity was invented and built by the Station for its own use, while 35 small 10 oz. machines and a number of Orlandi incubators (9 oz.) were lent to rearers in the neighbourhood. The cost of the small incubators (10 oz.) was 17.5 pesetas (14s) and the heating arrangement each would come to another 2 pesetas. Full instructions for working were supplied with each incubator. Inspectors from the Station also visited 135 farms where 314 oz. of *graine* were being dealt with, and at the station itself the incubation of 123 oz. was carried out for 128 rearers.

3) *Microscopical examination of silkworms and their eggs.* — Rearers were invited to have their eggs tested for *pebrine* and a considerable amount of this kind of work was carried out (Table I). At the same time a

TABLE I. — *Results of the microscopic examination of silk-worm eggs.*

Years	Silk-worm eggs produced by private person			Silk-worm eggs produced by the Station		
	Number of specimens	Number of cells	Average per cent of infection	Number of specimens	Number of cells	Average per cent of infection
1911	177	21 916	8.57 %	38	6 915	10.90 %
1912	237	37 105	6.43	55	13 075	6.60
1913	930	108 692	20.94	87	24 172	22.05

A course of instruction was offered to rearers on the technique of examination and the provincial council awarded a microscope as a prize to those who became thoroughly proficient. Some rearers took full advan-

tage of the classes and registered a daily attendance during the 3 years 1910 to 1913 in spite of the fact that their homes were 10 miles away. The total number of men entered over the period was 30 of which 12 were awarded the prize. In 1913, owing to an epidemic of flacherie arising from some eggs imported from France, the number of worms submitted for examination was vastly increased.

4) *The baking of cocoons.* — Until the Station was established the rearers in the district had no proper baking plant, so that they were obliged to market their cocoons without delay and often lost over their hurried transactions. The baking was immediately undertaken by the Station free of charge and the value of the treatment was so clearly and quickly demonstrated that a cooperative society was soon formed for the erection of ovens on the Murcia plain. In the 3 years 1911 to 1913 the new plan dealt with over 25 tons of cocoons for its members, while the Station treated about 22 tons in 1911 and 8 tons in 1912.

In 1913, no heating was done at the Station as the oven in the new premises was not yet ready.

5) *The free distribution of eggs.* — In Table II are set out details of the distribution of silkworm eggs.

TABLE II. — *Silkworm eggs distributed by the Silk Experiment Station of Murcia between 1910-1913.*

Periods	Provinces	Villages	Breeders	Amount of silkworm eggs
December 1910	14	28	36	49 ounces and 20,30 gm
Year 1911	20	42	96	75 " " 27.50 "
Year 1912	20	58	186	116 " " 20.8 "
Year 1913	20	46	240	138 " " 22.50 "

6) *Demonstration farms.* — In cases where the nature and position of a farm and the quality of its farmer make it suitable for demonstration purposes, the Station provides a free equipment. This includes young mulberry trees to supplement or enlarge the plantations, grain and all apparatus required for the rearing of silkworms, including an incubator. When possible, a skilled workman is also sent from the Station for the rearing season, but in any case help and advice are always given and the demonstration farms are looked upon as official sub-stations. During the years 1911 to 1913, 39 such farms were established.

7) *Free distribution of mulberry cuttings and seeds.* — From 1910 to 1913, 60,753 cuttings and 18 lbs. of seed were distributed.

8) *New headquarters of the Station.* — The State has taken over land from the Province in order that the Station should be enlarged and reorganised. The grounds now include 2 $\frac{1}{4}$ acres of newly planted mulberries, 21,000 1-year old trees, 21,000 2-year old trees, and 9,000 3-year

ld trees. Irrigation can be practised if necessary as there is a good well ith a motor pump. A new oven for cocoons has been built.

g) *Development of the various branches.* — The writer points out hat the organisation will need to be extended more particularly as follows:

a) The cultivation of the mulberry tree must receive more attention, manurial trials should be made and methods of pruning tested.

b) Itinerant inspectors and advisers should be appointed.

c) Cold storage should be established for the hibernation of *graine* with store rooms large enough to hold 30 000 oz. of *graine*, so that all the earers of the Murcia district would be able to use them.

d) The Station should undertake the disinfection of rearing houses s enquiries on this subject are constantly being received.

e) The foundation of a practical School of Agriculture and of school for the special training of workmen is also under consideration.

204 - Wild Silkworms of Africa — See this *Bulletin* N°. 1162.

AGRICULTURAL
MACHINERY
AND
IMPLEMENT

FARM ENGINEERING.

205 - *Manufacture and Co-operative Supply of Agricultural Machinery and Implements in the Russian Empire in 1913* (1). — I. Демповой М.), (DECHEVOJ M.), Manufacture of agricultural machinery in Russia, in *Машини въ сельскомъ Хозяйствѣ* (Agricultural Machinery), Nos. 10 and 11, pp. 392-394 and 430-434. Kiev, May 31 and June 15 1916. — П. Ковалъ В. (KOVAL V. D.), Co-operative supply of agricultural machinery, *Ibid*, No. 1, pp. 11-16. Kiev, January 15, 1916.

I. — The Office for Agricultural Machinery in the Russian Ministry f Agriculture has collected data as to the manufacture of machinery and implements in Russia in 1913. The more important of these are as follows.

The total number of undertakings engaged in the production of agricultural machinery and implements in 1913 was 921 (against 826 in the previous year), of which 770 were in 48 provinces of European Russia, 108 in Poland, 27 in the Caucasus and 16 in Siberia. All these concerns manufactured in 1913 machines and implements of a value of £ 6 437 000 £ 5 366 000 in 1911 and £ 5 600 000 in 1912, of which £ 5 841 000 came from the provinces of European Russia, £ 491 700 from Poland, £ 45 070 from the Caucasus and £ 59 260 from Siberia. The industry has developed specially in Southern Russia, notably in the province of Kheron, followed a decreasing order by the provinces of Ekaterinoslav, Taurida, Kharkov and the Don Cossacks. Elsewhere the manufacture of farm machinery is highly successful in the provinces of Moscow, Orel, Kiev, Livonia, Warsaw, Perm, Kaluga and Lublin.

(1) On this subject : in 1911, see R. 1914, No. 562 ; in 1912, see R. 1915, No. 949.

As regards output the factories are divided into the following four groups:

Value of output of each factory	Number of factories	Total value of output
1) less than £ 1 064	568	149 900
2) from £ 1 064 to £ 10 640	248	900 600
3) from £ 10 640 to £ 106 400	96	2 895 200
4) more than £ 106 400	9	2 492 200
Totals	921	6 437 900

Value and distribution of the output of agricultural machinery and implements in 1913

	£	£
Implement for soil cultivation	Ploughs	187 000
	Harrows and cultivators	147 000
	Rollers	13 000
Drills	In rows	654 000
	special and combined	59 000
	broadcast	41 000
Machines and implements for hay making	Scythes	107 000
	Mowers	900
	Rakes and tedders	5 000
	Baling presses	35 000
Machines and implements for corn harvesting	Sickles	58 000
	Mowers	907 000
	Reapers	193 000
	Binders	400
Thrashing machines	horse	1 471 000
	steam	23 000
	hand	18 000
	special	9 000
Apparatus for winnowing and sorting grain		263 00
Machinery for manufacture of feeding stuffs		149 00
Motors		356 00
Other agricultural machines and implements		704 00

The third group is thus the most important, while the last, with only 9 works, produced 38.7 per cent of the Empire's total output.

The total number of employees engaged in the industry in 1913 was about 40 000.

The value of the output of agricultural machinery and implement in 1913 is divided as shown in the accompanying table. The production of thrashing machines comes first, followed by cultivating, harvesting and sowing machines; then come motor machinery, cleaning and sorting

machines and finally machines for preparing food stuffs. The largest increase in output in 1913 was in thrashing machines. Before the war the demands of Russian agriculture for this type could be almost completely satisfied, with the exception of steam thrashing machines. The output of very small works is not included in the above data, as exact figures are not available, but this is very considerable throughout the Russian Empire.

II. -- The co-operative supply of farm machinery in Russia is assuming some importance. Actually, of a total value (£ 13 000 000) of machines sold on the Russian market in 1914, 10.8 per cent, or £ 1 502 000 represents purchases made by members of credit associations or by their district societies.

The development of the co-operative supply of agricultural machinery by members of such organisations can be realised from the following figures: in 1912 1 638 co-operators bought goods value £ 677 000; in 1913 their number rose to 2 457 and value of their purchases to £ 1 011 000; in 1914 their number was 3 000, or 20 per cent of the total number (15 000) of co-operators in Russia at that time.

A good proportion of these co-operators are combined in district societies. Eleven of the latter included 723 co-operators, or 24.1 per cent of those dealing in agricultural machinery. The total purchases made by the 11 societies in 1914 reached £ 104 000, or 7 per cent of the total co-operative supply. The majority of the societies belong to Southern Russia and the value of the purchases made by each of them ranges from a minimum of £ 2 120 (Ekaterinlaw society) to a maximum of £ 32 000 (Ekatarinburg society). In spite of the large differences in their purchases, there is a common side to the societies' activities which should not be overlooked. The co-operative supply of machinery is not limited merely to acting as middleman between the manufacturer and the farmer, but is closely related to the improvement of agriculture in the district and consequently is co-ordinated to its needs. For example, almost half the societies have agricultural experts in their service or special adviser who regularly work for them. The greatest activity has been displayed by the Kouban society which has its own staff comprising: 6 agriculturalists, a special expert to the society and advisers in special branches.

The co-operative societies are not satisfied with dealing only, which does not touch the problem of providing the population with agricultural machines, and accordingly they have embarked on co-operative manufacture. An interesting example of this movement is found in the venture of the Melitopol society which has put up a factory for making winnowing machines with an actual output of 1000 per annum. As this venture proved very successful, the directors of the Melitopol society decided last year to start the co-operative manufacture of other agricultural machines. The Ekaterinburg society has also shown much energy in the construction of its factory: the initiative of this organisation has been favourably received by the Ministry of Agriculture, the Imperial Duma and the Zemstvos. The idea of forming co-operative factories for agricultural machines is under consideration in other societies, and if the latter succeed in combining

in one organisation, the « Central Society », the problem, according to the writer, should be solved in the near future.

1206 - **Motor Ploughing in France.** — I. DE CABAUSSÉ P. The present trend of mechanical cultivation, in *La Vie agricole et rurale*, 6th year, No. 41 (entirely devoted to mechanical cultivation) (1), pp. 269-274, 5 figures. Paris, October 7, 1916. — II. LEFORT H., New types of ploughs. *Ibidem*, pp. 275-278, 5 figures.

I. — The writer begins by relating the drawbacks of the light petrol tractor which depreciates quickly. He asks if there is not good cause for a return to steam traction. According to Massignon, president of a vineyard syndicate in Anjou, steam could safely be resumed if the makers would build light machines. It is weight only which puts these motors into dis-

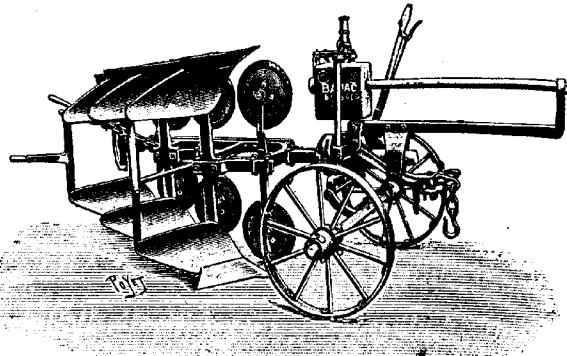


Fig. 1. — BAJAC counterbalance plough with moveable balance weight.

favour. The steam engine has an immense advantage over the petrol engine in flexibility: the former can develop, if necessary, three times nominal power, which the latter cannot do, and it gives a very uniform speed of traction. The return to steam traction will be hastened, according to the writer, by the high prices of paraffin and petrol, which are likely to be permanent on account of the increased consumption.

Besides the question of the tractor, the writer discusses the choice of the cultivating implement, and he considers the advisability of replacing the plough with coulter, share and mould board, by a driven implement.

At the Grignan trials, organised by the Minister of Agriculture in 1915, the judges were not favourably impressed by the machines with driven implements. The writer thinks that the latter should not have been rejected.

(1) Besides those abstracted, this number contains the following articles: Dr. CHAVEZ, Mechanical cultivation. — SCHIRBAUX Motor cultivation and soil tilth. — P. BUCHARD, Demonstration of machines for motor cultivation. — P. BUCHARD, Public trials of cultivated machinery in 1916. (E. N.)

without a larger number of trials: their success depends on the proportion of moisture present in the soil at the time of ploughing.

The writer further deals with cable traction, but does not think that there is much scope for this in France.

II. The majority of the ploughs used for motor cultivation are identical with those designed for animal traction. The only difference is in the greater number of furrows which they can make.

It is difficult to improve the working parts of ploughs so the greater number of modifications during the last few years have centred round the ease of handling the implement.

The writer thinks the BAJAC counterbalance plough with moveable balance weight is particularly interesting (fig. 1): the effort to reverse the

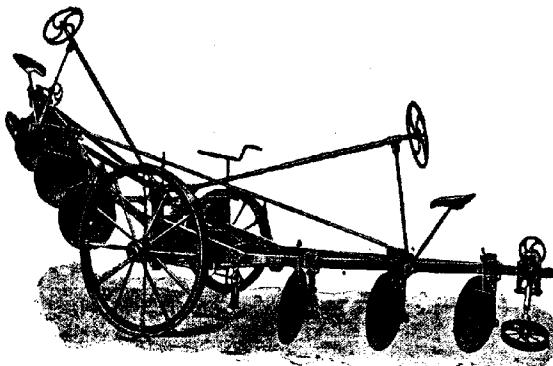


Fig. 2. — BAJAC disc plough.

plough at the headland becomes excessive when the weight of the machine is increased. In order to avoid this, the designer has placed the moveable balance weight on a sliding rod in front of the plough; the length of the rod is calculated so that the weight of the moving mass almost exactly balances that of the body when it is at the extreme end of the rod. The effort required to turn the machine is then very slight; on the other hand, when working, the weight is carried a little behind the place of support, on the body side, which increases the grip.

The writer also mentions the BAJAC disc plough (fig. 2) and the GERTAN plough with automatic lift, (fig. 3) specially designed for mechanical cultivation. This machine uses the adhesion of the soil to the supporting wheels of the plough to lift the shares. The shares are raised, not in one block, but one after the other; the same method is used for starting the furrows.

To mitigate the trampling of the animals at the bottom of the furrow, the writer notices the GERTAN plough; he also mentions the MELANI plough with turning fore-carriage — the FLOVER balance-plough which can make

at will either furrows 12 inches broad and 8 inches deep or 16 inches broad and 12 inches deep.

Other recent improvements tend to facilitate the manipulation at the headlands; in the system FALKENBERGER (1) the two bodies turn simultaneously around a horizontal axis, the rotation being caused by the reaction of the ground on the moving body through the agency of a stop. The " Syracuse Reversible " plough has two bodies mounted on separate beams, one turning the furrows to the right, the other to the left; the share is lifted by a pedal or by a spring mounted on a lever which transmits the task of lifting the share to the team, leaving the driver free to steer the team.

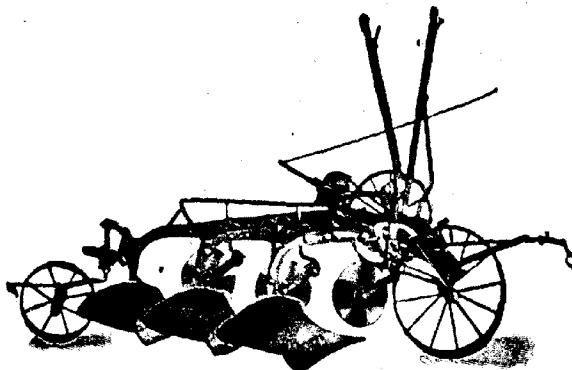


Fig. 3.—GILTLE plough with automatic lift.

at the turns. The other share turns automatically and the whipple-tree comes into place by sliding to the end of a hake, so that the machine follows the line of traction.

In order to lift at the headland in some types of multi-furrow plough the tractor driver has only to clutch a cam-shaft when all the shares are successively lifted. The power required is thus small and the headland is not left in a saw-tooth pattern which reduces the tilth. The writer also describes the "Leviathan" drain-plough (already noticed and illustrated in Bulletin 1915, No. 1329), exhibited at the Smithfield show (London) December 1915 by Messrs MACLAREN.

1207 - Simple Method of Calculating the Cost of Mechanical Cultivation. —

FONTGALAND A. (Correspondent) in *Comptes Rendus des séances de l'Académie d'agriculture de France*, Vol. II, No. 28. Paris, July 10, 1916.

An easy method of finding the cost of work to be paid by each member of the organisations for mechanical cultivation is very desirable. Experience of motor-ploughing shows that the petrol consumption (and hence

(1) See *B.* 1915, No. 420.

e net cost of the work) varies in the proportion of 1 to 3, according to type of soil and the depth of ploughing. On these data M. de PONCINS, agricultural advisor to the « Union du Sud-Est » (France), instead of taking a basis the area and depth of work or the time taken, has found it much simpler to base his costs on the actual consumption of petrol on the work.

The members thus pay only for petrol used, at net price, plus a surcharge of 1s 10d per gallon to cover other costs, calculated in the following way:

Assuming that the tractor works on average 150 days each year, at a rate of 5 acres per acre per annum, and that, on average soils it uses about $4\frac{1}{2}$ gallons of petrol per acre.

The surcharge then amounts to 8s 1d per acre, divided as follows:

	s	d
Depreciation of tractor: £48c in 4 years . . .	3	$1\frac{1}{2}$
Labour: 2 men	1	7
Oil, grease, waste.		$11\frac{1}{2}$
Insurance: fire and accident: £13 per annum. . .		4
Repairs: £36 per annum.		$11\frac{1}{2}$
Spares, general expenses, sundries		$11\frac{1}{2}$
	8	1
Total per acre	8	1

These annual costs amount to £300 for 750 acres, or 62.5 per cent of the price of the tractor.

For example, if a member's job has consumed 88 gallons of petrol, pays the society the cost of 88 gallons plus $88 \times 1s 10d = £8 1s 4d$. Taking the net cost of petrol at 2s 9d per gallon and supposing two ploughing jobs, one in light soil using 2.1 gallons per acre, the other in very heavy soil (5.3 gallons per acre), in each case the cost per acre will work as follows:

	Soil			
	Light		Very heavy	
	s	d	s	d
Petrol used.	7	$3\frac{1}{2}$	14	7
Surcharge	4	10	9	8
Total	12	$1\frac{1}{2}$	£1	4 3

Accounts are thus easy to make out and the management is simpler, it is only necessary to measure the petrol used.

Dust Explosions and Fires in Grain Separators in the Pacific Northwest. — ICE J., in *United States Department of Agriculture, Bulletin, No. 379*, Washington, C., August 1916.

In a very detailed study, the writer examines in the first place the causes which have produced some 166 explosions from the middle of July to end of September 1915. He then shows the means used for fighting as well as the results obtained which were most conclusive. A whole series of observations have made under the direction of the

Department of Agriculture during the summer of 1914 (1). The hypothesis of spontaneous combustion of smut-dust which was current at this time lacks confirmation. It was abandoned in favour of the theory of static electricity. As at this date it was already suspected that the dust produced during threshing had been the cause of accidents, the Department of Agriculture towards the end of the 1914 season procured samples of smut-dust from threshing machines. This material proved to be extremely inflammable; it was necessary therefore to direct the investigation in this direction in order to solve the problem.

This important question was examined by a number of experts from the "Bureau of Chemistry", and from the "Office of Public Roads and Rural Engineering". In about 150 cases the investigators were on the scene at the time of the explosion or very soon after. In some cases the explosion was so sudden that the workmen could give very little information.

The accidents occurred most frequently from the end of July to the end of August; from 6 to 10 explosions each day were recorded during this period (2). From observations made in 128 different cases, the most critical time of the day is from 2 to 7 p.m. In 81 per cent of the cases the fires were put down to dust explosions; in the other cases the flame produced was small. Particular care was directed to the point of origin of the explosion or fire: in 82 out of 108 cases observed (76 per cent) it was behind the cylinder, or very close to it.

Two hypotheses have been put forward to explain the fires: (1) incendiary; (2) natural causes.

The first hypothesis has been discarded. There only remains the second explanation and in 75 per cent of the cases the accident is attributed to static electricity and to explosions of dust from smut-wheat.

The threshing machines were of many different kinds: the power does not seem to have any influence. In fact as many explosions occur in machines driven by petrol motors as in those driven by steam. Out of 113 machines examined; 18 had petrol motors, 93 were driven by steam engines, 1 by an electric motor and 1 by horse power. Although the steam-driven machines were in a great majority, they were not subject to frequent accidents, contrary to general opinion.

The speed of the machine, although sometimes excessive, does not seem to have any connection with the origin of the fire.

Out of 112 explosions, almost all of which occurred during threshing, the wheat contained from 1 to 35% of smut. 15% of the explosions occurred with dirty wheat. Only 3 explosions occurred with perfectly clean head.

The question of hot axle boxes as a cause of fire was examined with negative results.

(1) See R. 1915, No. 536.

(2) It was practically the same as in 1914.

The damage to the machines varied from slight derangement to total destruction. The total damage for all machines was \$ 60 000.

In almost all cases the flame from the explosion was blown into the raw pile and sometimes spread to the grain in sacks. Several hundred bushels of grain were thus destroyed, the loss amounting to about \$ 50 000. Twenty-five per cent of the machines were provided with some form of extinguishing equipment.

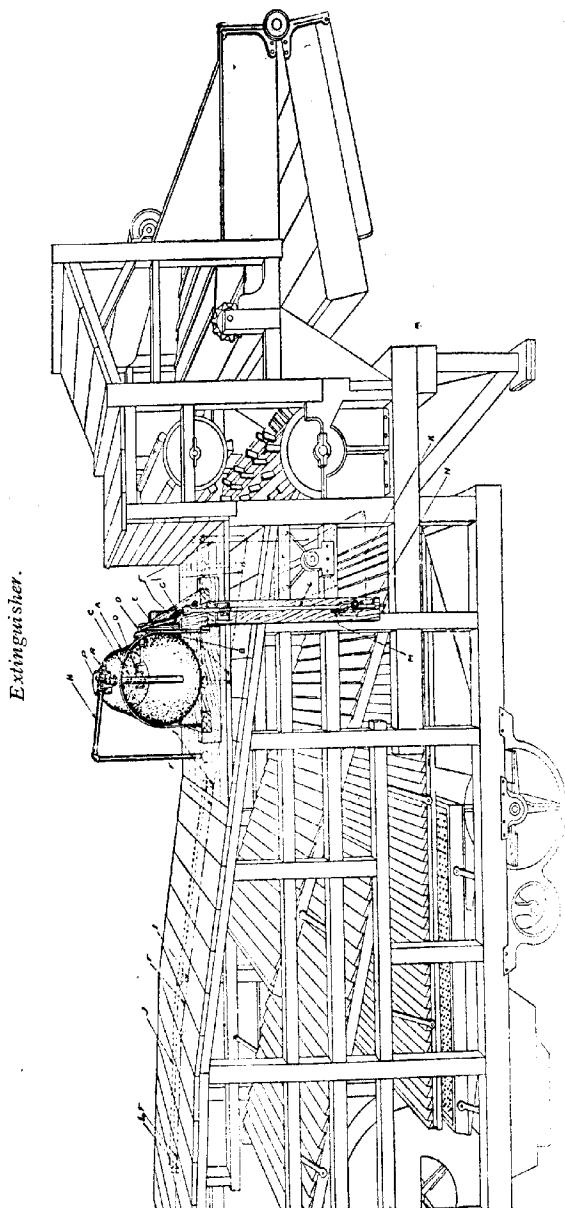
Static electricity as a cause of explosions. — It was evident from the beginning of the investigation that a large quantity of static electricity was generated during the operation of the threshing machine. The writer quotes a case in Idaho where a machine was completely destroyed as the result of an explosion. It was situated more than 15 miles from the railway and more than 4 miles from the main road. On the other hand the workmen were neighbours or men known to be reliable. The enquiry made it quite clear that the fire was due to static electricity (the weather was hot and dry). The wheat contained 31 % of smut.

In another case the owner of a threshing machine had his attention drawn to the cylinder at the time of the explosion. He observed a long electric spark coincident with the explosion.

In one case the owner stated that his machine was very heavily charged with electricity on the morning of the explosion, to such an extent that it was not possible to touch any metal part without shock, a condition which had never been noticed on this machine before. The explosion was violent and totally destroyed the machine.

Mill explosions. — The theory of dust explosions is not exactly new, and yet it is not generally believed that an explosion can occur in the absence of inflammable gas. But experiment has shown that dust produced by handling wheat can be ignited and cause serious explosions. The extremely fine state of division of the dust, combined with a sufficiently high temperature bring about the phenomenon. It has been shown in the laboratory of the University of Idaho that an electric spark can explode dust. Experiments made in the "Pittsburgh Testing Station of U. S. Bureau of Mines" indicate that to produce complete combustion of 0.12 oz. of coal dust requires the oxygen in 1 cubic foot of air. Cereal smut dusts are very inflammable, more so than ordinary cereal dust. The explosions observed were of two different kinds: one quick and sharp and the other resembling a loud roar, lasting longer than the first and accompanied by more flame. The concussion produced by the original ignition shook the dust settled in the machine and gave rise to the explosion flame. The mixture of smut-dust and air may have limits of explosibility, and it is quite possible to have too much or too little dust present for an ignition. For this reason explosions may occur at a given time and under certain conditions and not occur at other times or under different conditions. These conclusions are drawn from the Pittsburgh experiments mentioned above.

Methods developed for preventing explosions or extinguishing fires. — The writer described the investigations made on this point. The first method consisted of an arrangement of conducting wires connected to all the moving



arts to one part and from this part a single conductor is led to earth. This a repetition of the 1914 experiment but considerably more points were connected to earth.

The second method used a suction fan in order to prevent the formation of an explosive mixture.

These two methods have been used with success on some machines whilst others which were not so fitted were burnt.

Automatic fire extinguisher. — As it was not possible to demonstrate that the above methods actually prevent explosions, the investigators decided to rely upon an automatic fire extinguisher which would afford protection irrespective of the cause of the fire. Such a device, illustrated in the figure given here, is composed of the following parts : a tank A mounted on top of the machine, contains a bottle C filled with sulphuric acid : a discharge pipe H ; a tripping mechanism composed of operating levers G and a main tripping lever L ; a trigger N ; discharge nozzles I ; and fuses F mounted in a wire line.

The tank is filled with a solution of carbonate of soda. In the discharge pipe between the tank and the machine may be mounted a three-way valve from which a hose connection may be made for extinguishing outside fires.

The apparatus works as follows: the presence of sufficient heat will melt one of the fuses F, break the line wire thus releasing the trigger which frees the tripping mechanism. This breaks the bottle containing the sulphuric acid which falls into the soda solution and sets free carbonic acid. This generates sufficient pressure to force the water through the discharge pipe and the nozzles to all the crevices of the separator. The position of the fuses will vary with each machine and must be selected so that they are sure to be reached by the flame or heat, but not so placed that the wire connecting them is likely to be broken by the straw or by the moving parts of the thresher.

A full size working model was constructed and tested in the explosion galleries of the Bureau of Mines at Pittsburgh, and 27 trials were made. In no case did the extinguisher fail to operate successfully. Four different types of threshing machines were tried at the Arlington Experimental Farm and in each case the fire was extinguished before any damage was done.

39 - Mechanism for Clutching and Declutching the Feed Device in Straw Balers. --

Deutsche Landwirtschaftliche Presse, 43rd year, No. 78 p. 634, 2 figures. Berlin, September 27, 1916.

In automatic straw-balers different mechanisms have to be put in or out of action from time to time, at fixed intervals, through the agency of parts driven with a regular rotary or reciprocating movement. The operations are usually effected by means of a toothed wheel fixed in the compression channel which after a certain number of turns, brings about the necessary clutching. Now, as this toothed wheel moves slowly, it cannot give sudden movement; besides this requires a certain amount of power which the toothed wheel can only give partly or not at all.

These objections

of Wanzleben, Germany), to design a motion (German patent No. 292442) which is released by the moving parts of the press, and at the right moment by the toothed wheel. The latter does not perform the necessary work which is now done by the new piece of mechanism.

Figures 1 and 2 show the parts at two phases in the cycle of operations the toothed wheel *a* turns a cam *b*, controlling a weighted trip *c* which, after

Clutching and declutching mechanism.

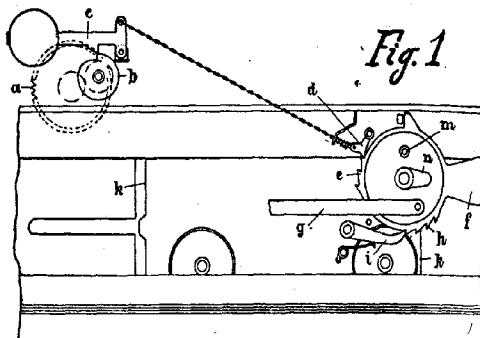


Fig. 1. — Clutching phase.

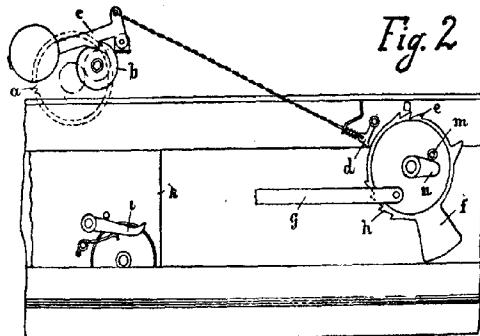


Fig. 2. — Declutching phase.

so many turns of the wheel *a* corresponding to the size of the bale, falls; thus releases the pawl *d* at the right moment; this in turn sets free a bale weight *f* furnished with ratchet teeth *e*, which passes from the position shown in fig. 1 to that in fig. 2, controlled by any suitable device, e. g. the pit and the stop *n*. This movement is used to clutch and declutch through *g* the link *g*.

In order that the final position may be maintained for a certain time and, on the other hand, that the original position may easily be regained, the following arrangement is provided : the balance weight *f* is fitted with a second group of ratchet teeth *h* with which a pawl *i* engages ; this pawl is linked to a part driven with a regular reciprocating motion, e.g. the compressor-ram *k*. At each blow of the ram, this pawl causes the balance weight *f* to advance one tooth at a time up to the last of the teeth *h*. Then the movement of the pawl *i* ceases to take effect, and the pawl *d* keeps the balance weight *f* in the raised position, as well as during the intervals in the ratchet action.

The cycle of movements begins again only after the toothed wheel releases the pawl *d* in the way just described. Then the weight *f* falls when the ram retires to the left, and the pawl *i* leaves the teeth *h*.

210 - Review of Patents.

Tillage machines.

Germany	290 344 Plough with harrowing device.
	290 345 Anchors for motor ploughs.
	290 821 Device for regulating the height of the chassis in motor ploughs.
	291 093 Device for fixing the depth of the furrows in double ploughs.
Austria	69 469 Device for regulating the height of the steering wheel in motor ploughs.
	69 486 Protective device for motor plough wheels.
	29 490 Device for repairing the mouldboards of ploughs after fracture.
	69 624-70 454 Motor ploughs.
Canada	168 447 Roller.
	168 558 Plough.
	168 605-168 642 Cultivators.
United States	1 186 880 Disc plough and cultivator.
	1 187 310 Control for cultivator chassis.
	1 187 326 Coulter and fixing device for disc harrows.
	1 187 488 Attachment for multi-furrow ploughs.
	1 187 559 Chassis for multi-furrow ploughs.
	1 187 560-1 189 365 - 1 189 587 Ploughs.
	1 187 789 - 1 187 790 Multi-furrow ploughs.
	1 187 870 — 1 191 430 Cultivators.
	1 187 907 Attachment for harrow.
	1 188 184 — 1 188 431 Attachment for ploughs.
France	480 370 Device suitable for motor ploughs and other multi-furrow machines.
United Kingdom	480 424 Soil cultivating machine. 5 328 — 6 305 — 8 564 — 100 612 Ploughs. 486 Harrow. 8 556 Motor plough.
Holland	1 480 Strike plough for sugar cane plantations.

Drainage and irrigation.

Germany	291 153 Irrigation system.
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Manufacture and distribution of manures.

United States	1 187 953 — 1 187 954 — 1 188 725 — 1 189 658 — 1 191 670	Manure spreaders.
France	480 509	Process for increasing the productiveness of the soil.
	480 569	New process for manufacture of compound manures.

United Kingdom 5 487 Manure distributors.

Drilling and planting machines.

Germany	290 049	Potato planter with cellular disc having edges bent back externally.
	290 133	Drill or manure spreader with easily raised distributors.
	290 567	Drill with one lever controlling both the covering coulter and the distributors.
	290 904	Potato planter.
Austria	70 261	Device for emptying the hoppers of drills.
	70 393	Potato planter.
United States	1 186 632 — 1 186 954	Drills.
	1 189 019	Corn drill.
	1 189 338	Potato planter.
Denmark	21 348	Potato planter.
	<i>Care of growing crops.</i>	
Germany	290 450	Sulphuring process.
	290 951	Process for controlling disease in vines.
	291 094	Grafting tool for fruit trees.
Austria	70 657	Diaphragm pump for sprayer.
United States	1 189 332 — 1 189 890	Sprayers.
United Kingdom	6 914	Singling hoe for roots.
	6 923	Singling hoe for turnips.

Destruction of vermin.

Germany	290 610	Process for destroying small rodents with powdered sulphur.
	290 611	Process for making insecticide.
Austria	70 513	Trap for musk rats (<i>Fiber Zibethicus</i>).

Harvesting machines.

Austria	69 982	Guards for hay-tedders.
	6 907 — 70 096	Rakes.
Denmark	21 364	Mower.
	21 398	Binder.
United States	1 188 190 — 1 188 210	Horse rakes.
United Kingdom	5 894	Hay-lift.
	6 768	Hay-tedder.
	8 242	Horse rake.

Machines for harvesting roots.

United States	1 187 873	Potato digger.
	1 189 255	Root puller.
	1 191 355	Beet puller and topper.
	1 189 853	Beet topper.

see 479 964 Device for laying beets and other roots in rows after mechanical pulling.

Winnowing and threshing machines.

Austria 70 113 Threshing machine with chaff extractor.
 United States 1 190 137 Clover-gin.
 1 191 853 Threshing machine.
 United Kingdom 100 850 Threshing machine.

Transport, dressing and storage of crops.

Germany 290 080 Mangold and straw cutter.
 290 568 Device for removing dust from chaff and grain.
 Austria 70 380 Installation for sulphuring hops.
 70 382 Hop drier with contiguous screens rocked in reverse directions.
 79 813 Chaff-cutter.
 70 814 Feed chain for chaff-cutter.
 71 101 Feed device for chaff-cutter.
 Canada 168 072 — 168 152 Silos.
 168 559 Feed mechanism for silage cutter.
 United States 1 187 739 Binder.
 1 187 363 — 1 187 742 Hay stacking machine.

Poultry farming.

United Kingdom 100 662 Incubator.

Manufacture of vegetable products.

Austria 69 623 Oven.
 69 627 Scraping device for kneading machine.
 69 658 Oven with moveable shelves.
 Holland 1 441 Apparatus for clarifying juice from sugar cane.
 1 458 Process and apparatus for extracting juice from sugar cane and other sacchariferous plants.

Dairy industry.

Germany 291 284 Butter making machine.
 Austria 69 488 Control device for milking machine.
 69 628 Plate centrifuge.
 69 829 Device for filling and closing milk bottles.
 Canada 168 280 Pulsator for milking machine.
 168 400 Pasteurising apparatus.
 168 826 Churn and butter maker.
 Denmark 21 315 Device for milking machine.
 France 48 050 Milking machine.
 Holland 1 092 Improvements in teat-cup diaphragms in milking machines.
 United Kingdom 5 582 Milking machine.

Steering and traction of farm machinery.

Germany 290 239 Steering gear for drills and similar machines.
 Austria 70 807 Plough tractor with steering wheel in front of driving wheel.
 Canada 168 223 — 168 224 — 168 439 Tractors.

United States 1191267 Steering gear for tractors.
 1191817 — 1191853 — 1191423 Tractors.
 United Kingdom 100436 Tractor.

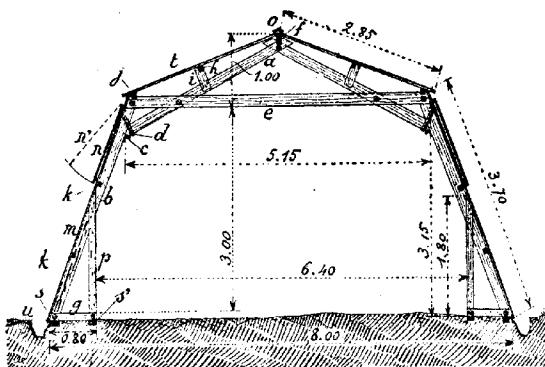
Miscellaneous.

Germany 291095 Tool for making holes for square piles.
 291377 Rubber pad for horse-shoes.

FARM
BUILDINGS.

1211 - **Portable Building.** — MAURIN G., in *Journal d'Agriculture pratique*, 80th yr, New Series, Vol. 29, No. 18, pp. 310-312, 2 figs. Paris, September 7, 1916.

The Gonot-Gorgeon portable building can be put to a great number uses : stables, byres, shops, dwelling houses, etc. The writer describes the simplest type of temporary structure which can be erected in a few days with previously prepared material.



Portable building - Transverse section.

The truss is formed of two stout uprights *b*, each connected with a rafter *a* by wrought iron strips *d*; the foot of the rafter butts on a ledge *c* fixed to the upright *b*. Coupling bolts hold the uprights and the rafters *a*. The foot of the upright *b* is triangulated by a strut *p* and tied to the latter by coupling bolts *g* which are seated on the raising-piece *s*.

The structure is closed by wood panels with but-joints and internal cross-bars, those for the roof being 9 ft. \times 3 ft. and those for the sides 12 ft. \times 3 ft. These panels are covered with tarred felt or similar material. The trusses are spaced 9.8 ft. from centre to centre.

The structure is very rigid and gives little hold to the wind. Rain water is discharged by two lateral drains *w*. The building can be floored and will last for some years, if treated every other year with a coat of tar and sand. A mixture of two parts of tar with one part of resin may also be used hot.

RURAL ECONOMICS.

212 - **The Sources of Farm Profits and Their Relative Importance.** — ONS D. H. and GUNN R. V., (Wisconsin College of Agriculture) in *Hoard's Dairyman*, Vol. LI, No. 23, pp. 900, 905, 918-821. Fort Atkinson, Wisc., June 30, 1916.

This report, presented at the third annual meeting of the Wisconsin State Farm Management Demonstration and Farm Contest, sums up the results of the third year's work in which nearly 1,300 farmers have participated.

As the majority of Wisconsin farmers grow four or five different crops and keep two or three classes of livestock it was necessary to find out how much each crop and each class of livestock contributes to the net results of the farm, in order to make a just award of the prizes given for farm management. The problem could only be solved indirectly, for the farmers had not kept detailed accounts but were only able to give, with any exactitude, the entries in their cash-books, showing the total receipts. No analysed figures were available as to the distribution of the expenses for labour, seed, manures etc. The question has therefore been approached in the following indirect way:

Careful cost accounting records kept by different Wisconsin workers under the direction of O. A. Juve of the U. S. Department of Agriculture, the Minnesota bulletin on the cost of producing farm products, the investigations of former Wisconsin Agricultural students, and figures taken from the chief writers on rural economy, have all been consulted in order to arrive at standard cost per crop per unit area, and per animal unit. This standard cost is the average for several farms for a series of years, so that extremes due to a good or bad year and a good or poor farm are avoided. The standard cost per unit for the various crops and classes of livestock has been worked out by the close and detailed analysis of available figures, and the results are given in Table I.

The profit per unit area for the different crops and the profit per animal unit for the various classes of beasts can be calculated by means of the standard cost per unit, being given the distribution of the crops of a farm and the number of beasts it carries, and also the gross yield for each crop and each class of beast.

This is illustrated in Table II. Column B shows the area devoted to each crop, and the number of beasts kept on the farm; column C gives the total cost based on the standard cost per unit; column D shows the percentage obtained by dividing the standard cost of each individual crop or class of livestock by the total standard cost; column E shows the distribution of cost obtained by applying the percentage in column D to the total expenses; column F gives the gross returns for each crop and each class of livestock; column G shows the profit on each crop and class of livestock, obtained by subtracting the actual cost (F) from the gross returns (F); column H shows the average profit per acre for each crop and per animal unit for each class of livestock.

TABLE I. -- Standard or average cost of producing crops and keeping live stock.

Crops		Live Stock	
Crop	Cost per acre	Class	Cost per animal unit
	\$		\$
Barley	14	Cattle kept by:	
Corn	18	General dairyman.	75
Oats	13	Pure-bred breeders	100
Peas	20	Market Milk Producers	
Rye	10	(Special).	125
Wheat	13	Sheep (7 sheep or 14 lambs).	75
Potatoes	30	Hogs (1500 lbs).	75
Alfalfa	13	Poultry (100 hens)	75
Clover	10		
Clover and Timothy	9		
Silage	25		
Pasture	5		

TABLE II. -- Application of method of using standard costs to determine the actual costs on an individual farm.

A Crop or class of livestock	B Acres or Units	C Standard Cost	D Per cent expense	E Actual Cost	F Income	G Profit	H Profit per acre or unit
		\$		\$	\$	\$	\$
Barley	4	56	1.3	52	131	79	19.75
Oats	17	221	5.1	204	327	123	72.35
Alfalfa	17	221	5.1	204	525	321	18.88
Clover	12	120	2.7	108	350	242	20.17
Clover and Timothy	20	180	4.1	164	420	256	12.80
Silage	17	425	9.7	389	472	83	4.35
Pasture	54.25	273	6.2	248	248	—	—
Cattle.	26.75	2 675	61.2	2 452	3 658	1 206	45.00
Hogs	2.7	199	4.6	184	282	98	36.30
Total . . .	—	4 370	100	4 005	6 413	2 458	—

TABLE III. — Standard and actual costs compared; average of 25 farms in Barron County.

Crops.	No. farms averaged	Standard cost per farm	Actual cost per farm
Wheat	16	109	110
Rye	25	204	211
Oats	2	360	419
Barley	6	44	46
Hay	6	39	50
Potatoes	9	246	243
Sugar beets	8	23	21
Yer	15	110	129
Wheat and Timothy	17	169	170
Grass	20	385	391
pasture	25	236	249
Livestock.			
Horse	25	1,552	1,627
Cattle	2	457	427
Geese	22	228	217
Total expense per farm		2,976	3,095

TABLE IV. -- Relative profitability of different farm crops.

A Crop	B No. of farms averaged	C Acres per farm	D Profit per farm	E Profits per farm
Wheat	41	8.7	67.58	7.74
Rye	34	12.3	28.18	2.28
Oats	72	18.4	114.45	6.21
Barley	2	18	370.00	20.55
Hay	13	7.7	43.54	5.64
Potatoes	16	.62	13.44	3.70
Sugar beets	10	8.5	186.86	21.88
Sugar beets	46	9.76	224.15	22.95
Yer	46	11.74	194.45	16.55
Timothy hay	58	17.14	152.53	9.37
Grass	65	19.43	— 58.64	— 3.92
pasture	75	43.4	—	—

In order to obtain a standard, this method was applied to a group of 25 farms, the resulting figures being given in Table III; it is obvious that in the average figures for the 25 farms there is a remarkable agreement between the standard expense calculated according to Table I and the actual expense obtained by applying the percentage figures to the total cost credited to each farm.

The average results on 78 farms divided into four different groups according to their size, show the same general tendencies and the same relative profitability of each crop that was indicated in Table III. The averages for the four groups are given in Table IV.

The same method was applied to the study of the livestock situation of 58 farms being considered, divided into three groups according to the cattle units they possessed. The results are indicated in Table V.

TABLE V. — *Relative profitability of livestock on 58 farms.*

		Number of farms	Units of livestock per farm	Profit or Loss per farm	Profit or loss per unit of livestock
Group I 25 farms	Cattle	25	19.6	— 410	— 20.95
	Sheep	3	6.1	— 68	— 11.04
	Hogs	22	2.8	48	16.52
Group II 18 farms	Cattle	18	26.6	— 417	— 15.63
	Sheep	3	3.2	— 101	— 31.56
	Hogs	15	4.4	49	11.11
Group III 15 farms	Cattle	15	38.6	1 146	29.64
	Sheep	—	—	—	—
	Hogs	6	2.25	44	19.55

On the 25 farms of group I only 3 are making a profit, while on 22 the livestock is kept at a loss in spite of the profit on the hogs. This is explained by the low production of the milking cows, which is only valued at £8 per cow. If the method of analysis is correct the profit of this group of farms is made on the crops and not on the livestock with the exception of hogs.

On the farms of group II the hogs were raised at a loss relative to the value of food consumed, while in group III a profit was realised both on milking cows and hogs.

For the purpose of comparison, calculations have been made of the returns for the food consumed in the 3 groups, the average of individual production for each milking cow and the receipts per animal unit. The

figures in Table VI explain the causes which influenced the results set forth in Table V.

TABLE VI. — *Returns for feed consumed.*

	Group I	Group II	Group III
	\$	\$	\$
Value of feed fed	1 280	1 424	3 311
Returns per \$ 1 of feed fed . .	1.17	.87	2.04
Receipts per cowdairy products .	58	62	114
Receipts per animal unit	65	45	173
Profits per animal unit,	— 16	— 18	30

The receipts from crops, livestock and from miscellaneous sources, with the corresponding profits are shown in Table VII.

TABLE VII. — *Total receipts and net profits per farm.*

Receipts and profits per farm	Group I	Group II	Group III
	\$	\$	\$
Total receipts,	3 265	2 867	9 741
Crops,	1 619	1 359	2 685
Livestock,	1 493	1 380	6 773
Miscellaneous	153	128	308
Net profits	174	405	2 086
Crops,	399	42	617
Livestock,	— 378	575	1 161
Miscellaneous	158	128	1 308

The third year's work concluded with the announcement of these results, visits to the farms and the award of the prizes gained. In the future much more exact information will be available. Prior to 1915 the records were obtained by the survey method by which the farmer is asked a series of questions, many of the answers to which must be estimates. In 1916, out of the 600 farmers interested in the work 365 kept their books in a satisfactory manner. For the coming year 1917 over 800 farmers have promised to keep their records.

Also, in 6 counties executive committees have been formed to organize the work of farm management work in their respective counties. The farmers themselves are so interested in the movement that the best results may be expected, and it is possible that in the near future they will contribute financially to defray expenses and to aid in the extension of this demonstration work.

1213 - **Statistical Researches on the Chief Factors Which Influence Farm Profit in Denmark.** — NANESON L., in *Dansk Land*, Year IV, pp. 35-53. Copenhagen, February 1916.

These statistical researches are based on data collected by the Office for Agricultural Accounts at Malmøhus (Malmøhus Lens Bogføringsstrenings).

The economic result of agricultural enterprise may be considered in various ways, depending upon whether the type of enterprise be of a capitalist nature or merely seeks to find a useful outlet for labour, as on the farms of the peasant proprietors. The wage value for the work done gives an index of the profit-making capacity of farms under peasant proprietors, and a comparison is made with the interest on capital on other types of farms. The statistical method is used for making this comparison in order to bring out clearly the factors by which farm profits are influenced.

Farms under peasant proprietors. — Data were obtained from 14 farms and a calculation has been made of the value of the labour of the owner family after deducting a fair interest on the capital laid out (at 4½ per cent for capital invested in land and 6 per cent for working capital) from the returns for the work done. Value for work done is compared with the normal wage value, calculated on the scale of the wage of the local labourers. This is set out in Table I, which also gives the net profit per acre and the rate of interest on capital obtained on each farm.

The large differences in the net profit per acre are accentuated in the rate of interest because of the different amounts of capital invested per acre. The rate of interest fluctuates from a minimum of 0.2 per cent to a maximum of 9.4 per cent, averaging 4.9 per cent for the 14 farms. Consequently, there are equally big differences in the wages earned by the owner's family, which vary from 47.5 per cent to 144.2 per cent of the normal wages, averaging 99.7 per cent. On account of these large variations, the farms have been divided into two groups according to the interest yielded in order to find out by what factors the profit-making capacity is determined. The factors for the two groups of farms are compared in Table II. In the first group the gross return from livestock is much greater than in the second, the return from cows and pigs being double, and that from other stock being more than double. In spite of their less favourable economic emplacement the farms of group I have given an increased net return of 44½ per acre, so that the interest in group I is 7.2 per cent and in group II is only 2.2 per cent. The value of the work done on the farms of group I is double that in group II, although the working expenses are almost the same in both groups. It appears, therefore, that intensive cattle rearing is the most profitable way of employing labour on the

TABLE I. — *Value of work done on the farms of the peasant proprietors.*

Farm	Net profit per acre	Rate of interest on capital invested	Return for work done by the owner's family			
			Calculated according to local wages		Actually obtained after deducting interest on capital	Actually obtained in percentage of local wages
			£	s	£	s
42	6 6	0,9	55	18	34 16	62,2
43	4 8 0	5,7	33	11	37 7	113,3
44	15 5	1,2	55	18	32 4	57,6
45	2 15 0	8,6	67	2	94 8	140,7
46	2 15 6	5,0	55	18	56 12	101,2
47	3 6 6	7,9	55	18	66 16	119,5
48	3 6 6	6,0	67	2	76 6	113,8
49	— 1 6	— 0,2	44	14	21 5	47,5
50	2 13 6	4,2	55	18	46 15	83,6
51	6 6	0,5	33	11	6 11	19,5
52	1 10 6	4,2	55	18	51 19	92,9
53	2 18 6	6,4	67	2	80 12	120,2
54	3 9 9	6,6	61	10	106 12	117,8
55	3 7 6	9,4	67	2	96 16	144,2

nm of the peasant proprietors, and that if this method be not practised is impossible to realise the normal returns on work and capital.

The lower profit-making capacity of the second group is partly due to the smaller area of the farms which average 2.75 acres less; if the farms are grouped according to area, the difference is less marked.

Area of farms	Net profit per acre	Rate of interest		
		s	d	per cent
Up to 10 acres	42 6			3,8
From 12.5 to 25 acres	48 6			5,7

In relation to the area, the value of the buildings was much greater in the first group than in the second but the number of farms studied is not great enough to allow of any general conclusion being drawn.

Other farms. — The diagram on page 1672 relates to capitalist farms and illustrates the statistics from 72 farms, which are arranged from left to right in diminishing order of the rate of interest they yield.

It appears from this diagram that there are great differences in organisation and intensity of working even on farms of similar size.

TABLE II. — Figures relating to the farms of the peasant-proprietors, Farms arranged in two groups according to the rate of interest yielded.

	More profitable group	Less profitable group	Difference
Average area	15.75 ac.	13 ac.	+ 2.75 ac.
Economic emplacement	3.0	3.4	- 0.4
Class of productivity	3.1	2.6	+ 0.5
Capital invested per acre	£ 35 8s	£ 40 7s	- £ 4 19s
Working capital	£ 14	£ 8 12s	+ £ 5 8s
Gross return from milking stock	£ 5 13s	£ 2 17s	+ £ 2 14s
Gross return from pigs	£ 3 17s	£ 2 4s	+ £ 1 13s
Gross return from other livestock	£ 1 18s	£ 0 16s	+ £ 1 2s
Total gross return per acre	£ 13 16s	£ 11 7s	+ £ 2 10s
Cost of labour per acre	£ 5 0s	£ 5 1s	- £ 0 1s
Cost of concentrated foods per acre	£ 2 17s	£ 1 18s	+ £ 1 19s
Total working expenses per acre	£ 10 0s	£ 10 3s	+ £ 0 6s
Net profit per acre	£ 3 8s	£ 1 4s	+ £ 2 4s
Rate of interest on capital invested	7.2 per cent	2.2 per cent	+ 5.0 per cent
Return for work done	£ 30	£ 14 6s	+ £ 15 14s
Return for work done in percentage of normal wages	125.3 per cent	69.0 per cent	+ 56.3 per cent

TABLE III. — Farms grouped according to the date of interest yielded

Group	Rate of interest per acre	Cost of labour			Working expenses less interest per acre	Net return per acre	Per cent of total yield	
		Capital	Gross return per acre	per cent of gross return			from crops	from stock
I	8.9	51 19	13 6	3 7	25.4	8 14	4 12	55% 31% 4
II	7.0	54 9	12 11	3 8	27.1	8 15	3 16	52 30 4
III	6.1	53 6	11 8	3 3	27.6	8 3	3 0	47 32 3
IV	5.4	57 6	11 6	3 3	28.1	8 6	3 1	46 30 4
V	4.2	53 4	10 8	3 6	32.0	8 4	2 5	51 29 4
VI	3.1	53 19	9 13	3 1	31.8	8 1	1 13	47 31 4
VII	0.8	49 14	8 12	3 6	38.3	7 19	1 13	42 36 3

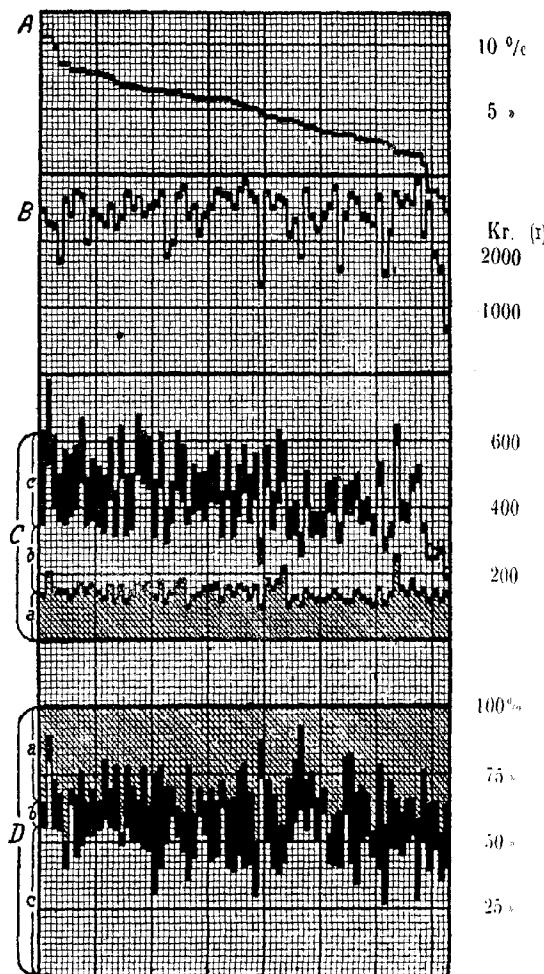
TABLE IV.—*Returns from the different groups of farms, arranged according to the intensity of cultivation.*

Group	Working expenses + interest per acre	Net profit per acre		Rate of interest	Economic Emplacement	Percentage of farms yielding an interest of more than 4 per cent
		s	d			
I	264 0	56	0	5.26	4.15	80
II	242 6	60	0	5.60	4.08	75
III	223 0	60	6	5.50	4.05	65
IV	206 4	59	6	5.77	4.05	70
V	192 6	55	5	4.56	4.05	65
VI	147 1	26	0	3.15	3.61	45

TABLE V.—*Returns from the different groups of farms, arranged according to the percentage of total returns that is derived from crops.*

Group	Percentage of total returns yielded by crops	Net profit per acre		Rate of profit	Economic emplacement	Productivity of cereal crops	Percentage of farms yielding a profit of more than 4 per cent
		s	d	per cent	point	point	point
I	60.2	66	0	6.51	3.95	3.82	80
II	53.5	65		6.17	4.05	3.91	80
III	50.5	48		4.62	4.10	3.83	60
IV	46.8	49	0	4.93	4.02	3.80	55
V	42.9	51		4.35	3.90	3.58	60
VI	37.9	45	0	3.82	3.97	3.41	50

turn. This is particularly noticeable on the two farms which yield the largest profit. On farm No. 2, the gross return per acre was 75s higher than that on farm No. 1, while the cost of labour was 31s per acre more. On farm No. 2 the crops provided 80 per cent of the total yield, whereas in No. 1 they only made up 55 per cent. As such different methods of organisation give similar economic results it is very difficult to specify the best types of farm for a given district, and any classification that is attempted is open to criticism. Nevertheless it is clearly evident from the diagram that the gross return per acre decreases with the profit-making capacity. This is shown still more clearly by the average figures for groups of 10 farms, given in Table III, where the gross return per acre falls from £ 13 6s in group I to £ 8 12s in group VII. This proves that the lower profit-making capacity is directly connected with the lower production per unit area. Comparing the best group with the worst the net return per acre fell from £ 4 12s to

DIAGRAM. — *Economic results from 72 farms.*

A. Rate of interest, per cent.

B. Capital invested per acre.

C. Gross returns: a) cost of labour

b) other working expenses

c) net profit per acre.

D. Percentage of gross returns derived from: a) cattle

b) various products

TABLE VI. — *Returns from the different groups of farms, arranged according to the percentage of total returns that is derived from livestock.*

Percentage of total return yielded by livestock	Net profit per acre	Rate of interest	Economic emplacement	Productivity : quantity of milk per cow (1 point = 264 gallons)	Percentage of farms yielding a profit of more than 4 per cent
s	d	per cent		points	
42.8	44 6	3.81	3.95	4.25	50
36.9	48 0	4.06	3.97	4.15	50
33.8	54 0	4.95	4.20	4.15	60
31.2	55 6	5.37	3.97	4.00	70
27.6	58 6	5.56	3.88	3.95	75
22.0	59 6	5.54	3.97	3.75	75

but the corresponding reduction in working expenses was only 15s. This explains why the rate of interest was only 0.8 per cent in the worst group, while it was 8.9 per cent in the best. The crops provide 55 per cent of the total yield in the best group of farms, and only 42 per cent in the worst, while the livestock represent 31 per cent and 36 per cent respectively.

Cost of labour. — The cost of labour per acre does not vary much in the different groups of farms, the greatest difference being only about 1s per acre. On the other hand, when compared with the gross return the labour expenses rise 125 per cent in the group giving the greatest yield to 38.3 per cent in the group giving the lowest yield. It is therefore clear that the great relative increase in the cost of labour is one of the chief causes of the poor economic results of the worst group of farms. This point has not been sufficiently considered in studying the economy of farming, and it deserves special attention, particularly when the cost of labour is high. Low economic results depend chiefly on excessive labour expenses in comparison with the return per unit area. The profits, both for crops and livestock, are much too low, and the reason can only be that the work is not properly looked after, so that the labourers become slack.

Relation between profit and intensity of cultivation. — The intensity of cultivation of a farm is indicated by the cost of labour and working expenses per acre with the interest on the land, i. e. by the total cost of production. Farms have been arranged in order on this basis, and have then been grouped in such a way that extra-ordinary factors have been eliminated as far as possible. In Table IV group I comprises the first 20 farms, group II the No. 11 to No. 30, group III No. 21 to No. 49 and so on. The two groups with the lowest intensity of cultivation give the poorest results, but the rate of interest reaches its maximum when the cost of production is £10 6s per acre, and decreases when this limit is passed, showing that the increase of intensity of cultivation beyond a certain point is not profitable.

Relation between profit and the relative proportion of crops and livestock.
In Table V the farms are grouped in descending order according to the percentage of the total yields given by the crops, and in Table VI according to the percentage of the total yields given by the livestock.

Increase in the percentage of crops sold is nearly always followed by increased profit, and there is no indication that a limit has been reached beyond which it would be disadvantageous to pass, but this is not the case with animal products. Two groups have been formed in order to study a second factor which affects the profits ; in group I the profit exceeds 5 per cent., in group II it is less than 5 per cent. Only those farms have been considered in which the return from livestock exceeds 35 per cent of the total return and the chief factors bearing upon milk production have been listed as follows :

	Group A	Group B
Number of farms	10	12
Rate of interest	6.4 per cent	6.4 per cent
Economic emplacement	4.2 points	3.8 points
Value of milk per gallon	$5\frac{3}{4} d$	$5\frac{1}{2} d$
Degree of productivity i.e. quantity of milk per cow, in points (1 point = 264 gallons)	4.3 points	3.8 points
Gross return per £100 invested in livestock	£125 18s	£93 2s

While the farms in group A yield a profit of 6.4 per cent, those in group B yield only 1.4 per cent. This is due to various causes : in group A the milk is worth $\frac{1}{4} d$ per gallon more than it is in group B, while the productive milk per cow is 132 gallons higher ; also the gross return from the livestock is 125.9 per cent in group A, but only 93.1 per cent in group B, the working oxen being about the same in both groups.

Relation between profits and the relative area under the various crops.
The percentage of the total area occupied by cereals, forage crops (e.g. forage, roots etc.) and industrial crops (sugar beet, potatoes etc.) has been calculated for most of the farms studied. In Table VII the farms are grouped in descending order according to the percentage of total area occupied by each of the three classes of crops.

The greatest profits are made by the groups of farms having 53 per cent of their area under cereals or 27.2 per cent under forage crops. If optimum is exceeded or not reached the rate of interest decreases until minimum is reached on those farms growing the largest proportion of forage crops and the smallest proportion of cereals. Increase in the area devoted to industrial crops causes the rate of interest to increase steadily and the maximum profit does not seem to have been reached even in the first group of 10 farms which have 20.2 per cent of their area under industrial crops. The extension of industrial crops seems to have a direct bearing upon the economic value of the "emplacement" which is a very important factor that must not be lost sight of in considering each group.

TABLE VII. — *Returns from the different groups of farms, arranged according to the percentage of the total area devoted to cereals, forage plants and industrial crops respectively.*

Group	Percent-age of total area	Net profit per acre	Rate of interest	Econo-mic emplace- ment	Pro- ductivity	Percent-age of farms yielding an interest of more than 4 per cent	Percent-age of total area devoted to industrial crops
<i>Cereals.</i>							
I	59,0	52,6	4,68	4,0	3,6	65	12,5
II	55,9	51,0	4,61	3,9	3,5	65	12,7
III	53,4	54,6	5,25	4,0	3,6	65	13,4
IV	50,8	55,0	5,12	4,2	3,8	60	14,0
V	45,7	49,0	4,48	3,9	3,8	55	15,1
VI	42,1	43,6	4,00	3,7	3,7	50	14,5
<i>Forage plants.</i>							
I	41,6	43,0	4,15	3,9	3,8	50	11,6
II	35,9	53,6	5,00	3,9	3,9	65	14,1
III	32,8	51,0	4,50	4,0	3,7	65	13,7
IV	30,6	52,6	4,50	3,9	3,5	60	13,2
V	27,2	58,6	5,55	4,1	3,7	70	14,8
VI	23,5	56,0	5,30	3,9	3,8	65	15,8
<i>Industrial Crops.</i>							
I	20,2	67,0	6,53	4,2	4,1	80	—
II	19,8	63,6	6,27	4,1	3,9	75	—
III	16,7	64,0	5,95	4,0	3,9	80	—
VI	14,0	54,5	4,76	4,0	3,8	65	—
V	12,1	42,0	3,71	4,1	3,6	50	—
VI	9,8	40,5	3,69	3,7	3,4	50	—

Generally speaking, the lower profit obtained when smaller areas devoted to industrial crops must be attributed to the lower economic hue of the emplacement and to the low productivity of the soil. High yields are also obtained in some of the groups in which the areas devoted to definite crops are far below the maximum limits. This emphasises the necessity of studying the economics of various combinations of crops more abundant statistical data than the author has used in these researches because when the number of farms in each group is relatively small influence of extraordinary factors does not permit of general conclusions being drawn.

TABLE VIII. — Returns from the different groups of farms, arranged according to the percentage of the total area devoted to cereal crops.

Group	Percentage of the total area devoted to cereals	Net profit per acre	Rate of profit	Economic emplacement	Productivity	Percentage of farms yielding a profit of more than 4 per cent	Percentage of total area devoted to industrial crops
		s			Points		
I	30.4	54	5.40	4.1	3.5	70	13.8
II	27.9	64	5.70	0.1	4.2	80	13.9
III	24.0	63	5.70	4.1	4.1	75	14.2
IV	21.7	60	5.35	4.1	3.9	65	14.8
V	19.7	45	5.25	4.1	3.6	55	13.6
VI	15.9	39	3.88	3.7	3.3	50	13.3

In Table VIII the farms are grouped according to the areas devoted to bread-making cereals (chiefly wheat). The rate of interest increases through the different groups to a maximum in group II (where cereals occupy 27 per cent of the total area), and diminishes again in group I, probably because the productivity points are low, owing to three farms which have a excessively low output apart from the cereals they produce. If these three farms are eliminated, group I with the largest area under wheat (31 per cent) gives the greatest rate of interest (6.8 per cent.) This shows that farms which arrange their land properly find the extension of wheat growing an excellent means of increasing their profit, particularly as in 1913, the year which provided the data on which these researches are based, the profit from wheat was somewhat decreased by the specially low selling price.

1214 — The "Mougharsa" Form of Contract in Northern Africa. — See this Bulletin No. 1161.

AGRICULTURAL INDUSTRIES.

INDUSTRIES DEPENDING ON PLANT PRODUCTS

1215. — Sulphurous Acid in Chemical Combination in Musts and Wines. — LABORATOIRE in *Revue de Viticulture*, Vol. XLIV, Nos. 1139, 1143, 1146, 1147, 1148; pp. 399-31373-376, 421-423, 437-440, 453-459; Vol. XLV, No. 1152, pp. 53-57. Paris, April: May 25, June 15, 22 and 29, and July 27, 1916.

Analysis proves that sulphurous acid which has been added to musts and wines exists both in the free state, that is merely dissolved, and also in chemical combination with the various constituents of these liquids. The difference between these two states is shewn very clearly by the iodine test, and it is very important from a physiological point of view.

Sulphurous acid has when free a very strong antiseptic action on wine yeast, which it loses almost entirely when chemically combined. There

the same difference between the two states as regards harmful properties when imbibed, and the regulations concerning the addition of sulphurous acid to fermented drinks have been made with this in mind.

All compounds formed by sulphurous acid in grape must or wine are unstable. They can be destroyed, and the sulphur dioxide completely expelled by heating the liquids to boiling.

The following points have been examined:

I. — THE CHEMICAL COMBINATION OF SULPHUROUS ACID WHEN ADDED TO GRAPE MUST. — The most important ingredient of musts which combines with sulphurous acid is the sugar, a mixture of glucose and fructose.

X. ROCQUES shewed some time ago that though saccharose does not combine with sulphurous acid, yet invert sugar combines very easily with it in aqueous solution, 1 gm. of sugar absorbing about 1 mgm. of it. This proportion is low, but can vary considerably.

Glucose and fructose were compared as regards their power of combining with sulphurous acid. Two solutions of 100 and 200 gms. per litre of invert sugar and a 10 per cent solution of glucose were prepared by allowing invertase from yeast juice to act at a temperature of 40° C. on solutions of saccharose. Other 10 per cent and 20 per cent solutions of invert sugar and 10 per cent solution of glucose were also made by dissolving saccharose in a 0.3 per cent solution of hydrochloric acid at a temperature of 80° C. On all these solutions, obtained by two methods, the effect was tried of adding 1 mgm. and 2 mgms of sulphur dioxide.

The results obtained after letting the solutions stand for 48 hours, all air being excluded, are given in Table I.

TABLE I. — Combination of sulphur dioxide with glucose and invert sugar.

Sulphur dioxide	10 per cent glucose solution		10 per cent invert sugar solution		20 per cent invert sugar solution	
	From yeast juice		From acid		From yeast juice	
	%	%	%	%	%	%
100 gms. free . . .	96	—	100	—	100	—
	54 (56.2)	65 (65)	76 (76)	54 (54)	59 (57.8)	22 (22)
	42 (43.7)	35 (35)	24 (24)	46 (46)	43 (42.1)	78 (78)
200 gms. free . . .	216	—	205	—	200	—
	104 (48.2)	140 (68)	149 (75)	144 (68.6)	126 (58)	65 (32)
	112 (51.8)	65 (31)	51 (25)	66 (31.4)	90 (42)	137 (68)

From this experiment the following conclusions may be deduced:

Solutions of invert sugar and solutions of glucose prepared by yeast will combine with much the same amount of sulphurous acid when they both contain the same amount of glucose. But invert sugar obtained by the action of hydrochloric acid and heat has a power of absorption double that of glucose, for in this case the fructose acts too.

The absorbing power of the sugar increases with the temperature and strength of the acid, especially when brought near to the point of caramelizing, and when this takes place it is the fructose which first decomposes.

As the proportion of sulphur dioxide which combines with invert sugar varies very much, the amounts of sulphur dioxide were compared which are absorbed by a natural must and by an artificial must obtained by the action of yeast on saccharose. Both musts contained 175 gms. per litre of sugar. The results are given in Table II.

TABLE II. — *Combination of sulphurous acid with grape must and with sugar solution.*

Amount of sulphur dioxide added per litre	Grape must				Sugar solution			
	Amount of sulphur dioxide combined			Ratio of combined to total sulphur dioxide	Amount of sulphur dioxide combined			Ratio of combined to total sulphur dioxide
	After 1 hours	After 24 hours	After 48 hours		After 1 hours	After 24 hours	After 48 hours	
mgms.	mgms.	mgms.	per cent	mgms.	mgms.	mgms.	mgms.	per cent
100	80	90	95	95	38	45	50	50
200	150	165	170	85	75	93	95	47.5
300	195	235	242	80	90	140	140	46.6
400	212	285	295	73.7	108	175	178	44.5
500	230	335	350	70	48	205	205	40.1
750	270	340	450	60	40	250	285	38
1 000	320	560	570	57	80	270	340	34
2 000	350	840	940	47	60	360	550	27.5

It has also been demonstrated that the organic substances which are with the sugar in the cell juices can combine with the sulphur dioxide. To prove this, there was added to one part of a solution of sugar inverted by invertase from yeast, the residue obtained by evaporating nearly to dryness an infusion of yeast corresponding in volume to about four times the sugar solution. In this way the non-sugary elements were considerably increased. To both these solutions, one with and one without the non-sugary yeast residue, and both containing 200 gms. of invert sugar per litre, were added 400 mgms. of sulphur dioxide. The same quantity of sulphur dioxide was added to some yeast juice made in the warmth and to some made in the cold. After 48 hours the sulphur dioxide had combined in the following proportions.

	Sulphur dioxide combined per litre	Residue per litre after evaporation to dryness
	—	—
Solution enriched with non-sugary substances	280	223
Solution of invert sugar	202	—
Yeast juice made in the warmth	23	156
Yeast juice made in the cold	90	540

Among other points that have been examined are the influence exerted on the combination of sulphurous acid by 1) the nature of the must; 2) the acidity, which at the strength generally used has no effect; 3) the temperature which, while hastening the action, has within the usual limits, i.e. from 15° to 25° C., but little effect on the amount combined; 4) the pressure of the atmosphere which has no influence either. A very low pressure can remove all the free sulphur dioxide, but only acts on combined sulphur dioxide if the temperature is considerably raised. A study has also been made of the disappearance in musts of sulphur dioxide due to evaporation and to oxidation into sulphuric acid by exposure to air.

The action of sulphur dioxide on special musts has been examined. According to experiments carried out by MULLER THURGAN and OSTERVALDER (1), must of healthy grape and of grape infected by *Botrytis cinerea*, to which 0.225 gm. and 0.450 gm. per litre of sulphur dioxide had been added, gave the following results.

History of must	Amount of sulphur dioxide combined			
	After 1 hour		After 3 days without fermentation	
	Healthy grapes mgms.	Infected grapes mgms.	Healthy grapes mgms.	Infected grapes mgms.
Must to which 0.225 gm. sulphur dioxide per litre was added	28	58	52	.80
Must to which 0.450 gm. sulphur dioxide per litre was added	36	78	98	.75

These experiments were repeated with *Botrytis cinerea* grown on grape must and on grapes. Some of the results are shewn in Table III.

TABLE III. — *The chemical combination of sulphur dioxide with must of healthy grapes and of grapes infected by Botrytis cinerea.*

History of must	Amount of acid per litre	Amount of sugar per litre	Amount of combined sulphur dioxide	
			Per litre of must	Per litre of sugar
	gms.	gms.	mgms.	mgms.
Must from various white grapes	7.1	158.6	264	160
Must infected by <i>Botrytis</i>	0.54	147.1	260	177
Must of Chasselas	2.50	161.2	270	167
Must infected by <i>Botrytis</i>	0.49	188.7	230	149

(1) See R. 1915, No. 738.

It thus appears that, contrary to the conclusions come to by MULLER THURGAN and OSTERWALDER, the increase in the quantity of combined sulphurous acid in the must of infected grapes depends on the concentration of all the ingredients of the must.

The following conclusions may be drawn from the experiments described above:

The combination of sulphur dioxide with grape must depends on the following factors:

1) The proportion of sugar, which can vary largely from that of healthy grape to that infected by *Botrytis cinerea*, called « pourriture noble » because of its enriching effect in certain wines.

2) The proportion of glucose to fructose which is generally equal to 1 in healthy grapes, but which sometimes is less, especially in the must of infected grapes; in this case the amount of combined sulphur dioxide tends to diminish as the fructose is inactive.

3) The existence of other substances than sugar in the must, and the acidity.

4) The physical conditions to which the must has been subjected.

5) A rise of temperature of the must, which, if it does not exceed 25°, hastens combination.

II. — THE INFLUENCE OF SULPHUROUS ACID ON THE FERMENTATION OF GRAPE MUST. — Previous experiments had shewn that if a moderate amount of sulphur dioxide is added to a must rapidly fermenting, it combines very quickly and without interrupting the fermentation. By repeated additions the relatively high proportion of 1 gm. per litre is reached for the combined sulphur dioxide.

A compound of aldehyde and sulphurous acid is produced, as PASSE RINT shewed in 1909, and the writer has studied it under the following conditions;

To begin with, he added to two portions of must about 200 and 400 gms. of sulphur dioxide per litre respectively, and this combined entirely with the sugar, and other ingredients of the must. The must was then mixed with pure yeast and allowed to ferment, care being taken to exclude contact with the air as much as possible, and the following changes in the quantity of aldehyde present were noted as the amount of sugar decreased:

Specimen to which no sulphur dioxide was added		Specimen to which 200 gms. per litre sulphur dioxide were added		Specimen to which 405 gms. per litre sulphur dioxide were added	
Amount of sugar destroyed per litre	Amount of aldehyde formed per litre	Amount of sugar destroyed per litre	Amount of aldehyde formed per litre	Amount of sugar destroyed per litre	Amount of aldehyde formed per litre
gms.	mgs.	gms.	mgs.	gms.	mgs.
20	60	8	105	12	230
59	125	106	224	59	740
127	145	162	224	85	370
162	135	194	210	140	370
200	95	215	200	166	360

Aldehyde is formed in the control specimens as in those containing sulphur dioxide, but in much smaller quantities.

The sulphur dioxide is recovered at the end of the experiment with but slight loss, 10 mgms. out of 200, and 15 out of 405. This proves that as fast as the sulphur dioxide is set free from the sugar by the latter's breaking up, it enters into combination with the aldehyde and is thus retained; whereas, if any considerable proportion remained free it would be carried off by the carbon dioxide and much would be lost.

The fermentation of the must is sometimes seen to take place in the presence of free sulphur dioxide, even when a test portion taken from the top of the cask contains a fairly high percentage of sulphurous acid. To explain this, it is suggested that in the lees at the bottom of the cask there is a layer where the free sulphur dioxide combines with the aldehyde produced by the incompletely sterilised yeast. Here fermentation begins, at first but slight, and then with greater and greater evolution of carbonic acid gas according as the layer in which the sulphur dioxide enters into combination, grows in extent. It has been possible to prove this by experiment.

III. — THE INFLUENCE ON FERMENTATION OF SULPHURIC ACID WHEN CHEMICALLY COMBINED. — *Changes in the rate of fermentation.* — The results of experiments undertaken to elucidate this question are shewn in Table IV.

TABLE IV. — *The influence on fermentation of sulphurous acid when chemically combined.*

Time elapsed	Fermentation at 15° C.								Fermentation at 25° C.							
	No. 200				No. 400				No. 200				No. 400			
	sulphur	sulphur	sulphur	sulphur	dioxide	dioxide	dioxide	dioxide	sulphur	sulphur	sulphur	sulphur	dioxide	dioxide	dioxide	dioxide
	a	b	c	a	a	b	c	a	a	b	c	a	a	b	c	a
gms.	gms.	gms.	per cent	gms.	gms.	per cent	gms.	gms.	gms.	gms.	per cent	gms.	gms.	per cent	gms.	per cent
1 day . .	0.8	0.15	0.15	19.0	19.0	2.2	1.05	0.65	47.5	30.0						
2 days . .	1.2	0.35	0.35	28.5	28.5	3.6	2.2	2.15	61.1	60.0						
3 . . .	1.65	0.65	0.65	39.4	39.4	4.65	3.25	3.05	70.0	65.6						
4 . . .	2.4	1.55	1.35	64.5	56.2	6.4	4.65	4.25	70.0	66.4						
5 . . .	3.2	2.95	2.00	91.5	62.5	7.45	5.8	5.35	77.8	71.8						

The antiseptic influence of combined sulphurous acid on wine yeast is thus shewn to be perceptible in certain conditions; nevertheless, when the proportion does not exceed 200 mgms. per litre, which is the maximum for musts purified in the ordinary way, the rate of fermentation is but slightly decreased, unless the temperature sinks to below the normal.

Changes in the selective affinity of yeast. — Normally, yeasts which cause grape sugar to ferment shew a marked preference for glucose. But

under certain conditions the contrary is the case, especially when fermenting must or re-fermenting sweet wine contains a high proportion of combined sulphurous acid.

One experiment shews clearly the influence of the sulphurous acid on the selective affinity of the yeast. But it is impossible to say whether this is due to a temporary modification of the protoplasm or to a survival of the fittest among the yeasts.

IV. — THE CHEMICAL COMBINATION OF SULPHURIC ACID IN WINES
Wine and must made from healthy grape and from grape infected by *Bacillus cinereus* were compared, and the results shewn in Table V. were obtained.

TABLE V. — *A comparison of must with wine.*

	Must from healthy grape	Wine from healthy grape	Must from botrytised grape	Wine from botrytised grape
	mgms.	mgms.	mgms.	mgms.
Free sulphur dioxide	40	20	40	16
Combined	160	168	160	168
Total	200	188	200	184

In both cases the power of wine for combining with sulphurous acid was very little different from that of the must; it was slightly higher because of the existence of traces of aldehyde in the former.

Experiments were also made on the capacity for combining with sulphur dioxide of wines which have fermented in the presence of sulphur dioxide. From the same must two specimens of wine were prepared, No 1 a control specimen, and No 2, which had been allowed to ferment in the presence of sulphur dioxide and which contained 296 mgms. sulphur dioxide and 220 mgms. aldehyde per litre. To both wines about 2 mgms. sulphur dioxide was added, and after 48 hours they proved to have the following amounts of sulphur dioxide.

	Wine No 1 mgms.	Wine No 2 mgms.
Free sulphur dioxide	20	16
Combined sulphur dioxide	168	480 (296 + 184)
Total sulphur dioxide	188	496

This shews that No 2 has in a combined state only a little more of the sulphur dioxide subsequently added than has No 1.

The checking of fermentation. — A litre of fermenting wine containing still 80 gms. of sugar per litre was divided into three parts, and to each part was added 66 mgms. of sulphur dioxide. To the first portion this

was added directly, to the second after heating to 80° C. to kill the yeast and then cooling, and to the third after filtering to remove completely the yeast. After standing for 48 hours, analysis shewed no difference between the three portions for all contained 20 mgms. of free sulphur dioxide and 176 mgms. of it combined. So the presence of yeast has no influence on the amount of sulphur dioxide that enters into combination when the fermentation is stopped, if the quantity added has been sufficient to stop fermentation at once. Nevertheless, with a view to the later preservation of the wine, it is better to eliminate by a preliminary racking the thick lees at the bottom of the cask, for this might give rise to a slow fermentation which would carry off the free sulphur dioxide.

The different factors which cause variation in the amount of combined sulphur dioxide have been examined, and the results are drawn up in Table VI.

TABLE VI. — *Different factors that regulate the amount of sulphur dioxide that enters into chemical combination.*

	History of wine	Total sulphur dioxide per litre	Combined sulphur dioxide per litre	Aldehyde per litre	Alcohol per cent	Sugar per litre
		mgms.	mgms.	mgms.	mgms.	
Sauvignon	Fermented	200	96	0.0	16.0	5.0
	Fermented*	196	146	50.0	14.0	55.0
	Without precipitation	182	126	80.0	14.0	4.5
	After precipitation	324	252	135.0	11.9	45.6
	Preserved normally	296	192	87.5	14.5	55.6
	Refermented	424	352	155.0	15.0	45.6
Montazillac	After several precipitations	392	392	200.0	11.0	127.0
		Wine { Without precipitation	220	140	100.0	13.5

The preservation of some wines of Gironde for about a year were studied, the amount of sulphur dioxide being kept constant by successive additions. It appears that its preservation during two years can be secured by a small total amount of sulphur dioxide if it is added at intervals.

CONCLUSIONS. — The following conclusions may be drawn from these experiments :

1) Sulphurous acid added to grape must soon enters into chemical combination, partly or wholly. The sugar absorbs most of it, but only the glucose, for the fructose is inactive. Other ingredients of the must can also combine with it in measurable quantities which depend on the nature of the must. In an ordinary must when the quantity of sulphur dioxide added reaches 100 mgms. per litre, complete combination no longer takes place, and the proportion of combined sulphur dioxide to total sulphur dioxide decreases as more is added. A state of equilibrium between the free

and combined sulphur dioxide is reached which varies with the nature of the must and the total amount of dioxide. Certain changes, however, in the nature of the must appear to have no appreciable influence on the proportion of combined dioxide; such are changes of acidity within ordinary limits and the direct action of *Botrytis cinerea*.

2) Sulphur dioxide forms a chemical combination with the aldehyde in the must and is thus completely retained in the wine. The aldehyde is produced by the action of yeast on sugar in the absence of air and when combined with sulphurous acid it escapes much more easily from all hydrogenising and hydrolising actions, which are at their strongest when the yeast has reached its maximum growth and the sugar has grown less.

3) In spite of the greatly reduced antiseptic properties of sulphur dioxide when combined, its presence in a fermenting must can modify the physiological action of the yeast. The increase in production of aldehyde is a proof and further experiments would produce others; an analysis of the products of fermentation would show this.

The rate of fermentation is lightly lessened even by a small amount of combined sulphurous acid not exceeding 200 mgms. per litre, especially at first, and if the temperature is somewhat low; at 25° C. the retarding effect is much less than at 15°.

Finally, the selective affinity of the yeasts seems to be so much influenced by it that the proportion of glucose to fructose becomes higher than 1 during fermentation, and this influence should be studied further because of its effect on the constitution of sweet wines.

4) The proportion of combined sulphur dioxide in cheap table wines, ("vin ordinaire") does not differ very much from that in the must which produces it. But in the case of a grape must infected by *Botrytis cinerea* and very rich in sugar, the sweet wine it gives rise to has generally a much smaller combining power, very much the same as that of a "vin ordinaire".

The addition of sulphur dioxide to a must changes but little the combining power of the wine obtained from it, for the initial dioxide is taken up by the aldehyde and the product formed is more or less independent of the other ingredients of the wine. But of course this initial combined sulphur dioxide is extra to the amount of combined dioxide formed by a later addition.

The checking of fermentation can be done in contact with living yeast without using excess of sulphurous acid, so long as enough acid is added to stop the fermentation completely, and that the lees are withdrawn as speedily and completely as possible.

Several factors may necessitate an increase in the total amount of dioxide needed to preserve sweet wines; they concern the method of wine-making, and the later treatment given to these wines. Thus, excessive aeration and a too prolonged fermentation favours the formation of aldehyde, and consequently the combination of sulphurous acid; but precipitation in presence of sulphurous acid and secondary fermentation after sulphiting have a greater effect in increasing the amount of sulphur dioxide which

enters into combination and, consequently, of the amount which must be used.

Therefore precipitation in presence of sulphurous acid, a method seldom now used for musts concentrated by *Botrytis cinerea*, must be avoided as much as possible.

Finally, during three or four years, the normal period of preservation of wines, a certain increase in the amount of combined sulphur dioxide must be expected. This is due to the formation of aldehyde, and to the concentration of the liquid by spontaneous evaporation.

These researches shew that sulphur dioxide in a state of combination plays a very complex part in wine-making, nearly as important as that of the free dioxide. The latter alone can ensure the preservation of sweet wines, and, consequently, care must always be taken that its proportion never becomes less than 25 to 30 mgms. per litre; but since the amount of total sulphur dioxide must never exceed a certain limit, the amount of combined dioxide must be watched also with much care.

Besides, it is always important to preserve heavy wines with as little total sulphur dioxide as possible, and hence it follows that the utmost care must be taken to diminish the amount that enters into combination.

²⁶ The Deseccation of Potatoes in Germany.—PAROW, in *Gesecse*, No. 73-74, p. 572
Koenigsberg, Pr., Sept. 9, 1916.

The deseccation of potatoes has made rapid strides in Germany. The number of factories grew from 3 in the first year, 1903, to 39 in 1906, 199 in 1909, 403 in 1912, and 488 in 1914.

The need for these factories has become more apparent than ever since the outbreak of the war, and the Government helps to start them granting subsidies. The "Trocken-Zentrale," at Berlin was directed to do all that was possible to hasten the construction of driers. The "Trocken-Kartoffel-Verwertungs-Gesellschaft" (Society for utilising desiccated potatoes) has been founded in order to collect and distribute the output, and this has helped to increase the number of factories to 1 in 1915. On July, 1916, there were in all in the German Empire 17 factories, which were distributed as follows among the different provinces:

Anhalt	40	Hanover	22
Bavaria	10	Hesse-Nassau	1
Bremen	8	Pomerania	151
Free Towns	1	Posen	152
Hesse, Grand Duchy	2	Rhenish Provinces	3
Saxony, Kingdom	9	Saxony, Province	44
Mecklenburg	27	Silesia	118
Westphalia	3	Schleswig-Holstein	2
Schwarzburg-Rudolstadt	2	Westphalia	2
East Prussia	43	West Prussia	71
Brandenburg	130		

The productive power of these works, although considerable, is not sufficient for the present need. The output is large, but is limited by insufficiency of material and workmen, etc. Whilst in 1915 it was not possible to get enough raw material, in 1916, thanks to a better harvest, there will be a bigger supply. But lack of workmen prevent the factories from being used to their full extent.

With the works going continuously day and night for 200 days all the factories of the empire are able to produce 12 million tons of dried potatoes from 30 million tons of raw material.

That the quantity produced by the whole empire does not meet the needs of the population is due to the fact that dried potatoes are wanted for horses too. For if each horse received daily only $4\frac{1}{2}$ lbs, 2.6 millions tons would be consumed by them in a year. Further, if cattle, pigs, sheep, goats and horses, a total of 60 million head of stock, received 2.2 lbs dried potatoes each daily, they would consume 21.9 tons of dried potato yearly, and this corresponds to 87.6 tons of fresh potatoes.

The technique of dessication has made surprisingly rapid strides the few years since it was first started. Cylinders, "Walzenapparate" and drums "Trommelapparate", are now generally used. The former can deal with 1.2 or 1.5 tons of potatoes per hour, and the latter up to 1 tons. The fresh potatoes are transformed into a dry substance which is easy to transport and which can be preserved almost indefinitely. They are generally made into flakes and cubes for cattle and into various potato flours for human consumption. The machines are easy to run; 8 to 10 h is enough for those of medium size and 15 to 25 for the larger ones. On average 12 to 14 tons of coal are used for 100 tons of potatoes for the making of flakes, and 8 to 10 tons of coke for the making of cubes.

The total cost of drying 1 cwt. of potatoes is 0.30 to 0.40 mark a from 0.40 to 0.50 mark in the smaller ones (a mark before the war equalled $11\frac{1}{2} d$ and has by now fallen in value to about 8d). The cost has gone slightly since the war. Because of the increased cost of desiccating at the high price of raw potatoes, a maximum price has been fixed for dried potatoes, 22.0 marks per cwt. of flakes and 21.42 marks per cwt. of cubes at the factory.

Reckoning that 4 cwt. of raw material make 1 cwt. of dried product and that 1 cwt. of fresh potatoes costs 4 or 4.5 marks, it will be seen that the desiccation of potatoes pays, even in war time, if the machinery is used to its full use. Higher profits are made if other vegetable products besides potatoes are used, and the greater their variety, the better. The machines for making cubes are the best for this purpose, for they can also desiccate beet root, leaves, cereals, grass, vegetables, and have earned the name "Allestockner" (universal desiccators).

Besides preparing stock foods, the machines for making flakes may also in the future be more largely used for preparing food for human consumption.

317.—**On the Action of Alkalies and Acids on Rubber.**—EATON, B. J., in *The Agricultural Bulletin of the Federated Malay States*, Vol. IV, No. 6, pp. 162-167. Singapore, March 1916.

In a previous number of *The Agricultural Bulletin* (Vol. IV, No. 2, Nov. 1915), it was shown that solutions of caustic soda and of carbonate of soda perceptibly hastened the vulcanisation of rubber obtained from plantation Para rubber, *Hevea brasiliensis*. Since it had also been demonstrated that vulcanisation is retarded by coagulation with excess of acetic acid, the hypothesis was put forward that the acceleration produced by soda was due to the neutralisation of the residual acid, and the production of a more favourable medium for the organisms which are believed to cause the more rapid vulcanisation.

In order to see whether it was by direct chemical action on the rubber that the alkalies hasten vulcanisation, further experiments were carried out on finished rubbers⁴, that is, rubbers in a crepe form. In this way the possibility of biological action was precluded by the dryness of the samples. Two types of rubbers were chosen, a fast and a slow curing rubber. The first had been prepared in the usual way by crepeing slab rubber which had been left standing at least six days, and the second by crepeing fresh caoutchouc on the day of coagulation. Solutions of caustic soda and caustic potash were used. From the results of these experiments the following conclusions may be drawn.

1) The effect of soda and potash on rubber is to increase markedly the rate of vulcanisation.

2) This effect is similar on slow and fast curing rubbers.

3) The effect of alkalies appears, at present, to be due to chemical action on some constituent of the rubber, but the evidence on this point is still incomplete, and further researches are being carried out.

4) Sulphuric and other mineral acids, potash alum and probably other mineral salts retard vulcanisation. Their effect is greater with quantities beyond the minimum necessary for coagulation.

5) The results obtained with mineral acids are important in connection with estate practice in view of the probable substitution of sulphuric acid for acetic acid, and show that great care will have to be taken in maintaining standard conditions, more so than in the case of acetic acid, in which a moderate excess over the minimum necessary for coagulation has little effect.

The use of alkalies in the preparation of raw rubber has a deteriorating effect on manufactured rubber goods. This entirely confirms the deteriorating effect found to occur even on the raw rubber after keeping.

318.—**New Dairy Industry Legislation in New South Wales, Australia.**—O' CALLAGHAN, M. A., in *The Agricultural Gazette of New South Wales*, Vol. XXVII, No. 6, pp. 409-414. Sydney, June 2, 1916.

The "Dairy Industry Act" which was passed December 21, 1915 and came into force June 21, 1916, amends the "Dairy Supervision Act" of 1912 and other acts dealing with the same matter.

The new law regulates the manufacture, sale, storage, transit and export of dairy produce, including margarine, the testing, mixing and

grading of creams, the basis of payment for cream, and for the grading and branding of butters. The Government has given wide powers to the Board of Agriculture, which now controls the work of butter factories throughout, and to a certain extent the work of cheese factories, condensed milk factories and margarine factories. New South Wales is a great butter producing country; hence the particular interest of this question, for it is only butter superior to that hitherto made that can hold its own against margarine in the English market.

When the Dairy Industry Act was passed by the Government, and creams were henceforward classified, the producers of highclass butters and creams benefited as a distinction is now drawn between their goods and those of inferior quality.

The law states that cream must be paid for either on the basis of the butter fat results, as shewn in the O' Callaghan Chart, or on the amount of butter obtainable from such cream.

According to Clause 12, the manager of every dairy produce factory shall grade or cause to be graded all cream supplied to him. He may not mix the various grades of cream or butter. Butter from graded cream shall be put up in packages bearing a brand registered under the Act representing the grade or quality and the factory if desired.

As hitherto creams of various qualities have been produced it was no easy to provide classification which would bring about the desired result and at the same time not be too severe on factory managers till they had got accustomed to the workings of the Act. The suggested classification avoids the necessity of grading into more than two qualities for the present. It is clear and simple, and does tardy justice to the producers of untainted cream.

Creams supplied to dairy produce factories must be classified as follows:

N.^o 1. — Untainted or choicest.

N.^o 2. — Tainted.

Untainted creams must be free from all taints, whether caused by the foods the cows have consumed or by bacterial or any other agency. Such cream should also have a smooth and even texture and should not contain more than 0.4 per cent of lactic acid.

Such creams when made into butter will reach the standard-minimum 95 points, prescribed in the Commerce Act for superfine butter. No penalty is inflicted if such butter during the 12 months subsequent to the gazetta of these regulations, grades a minimum of 43 points for flavour.

Tainted cream (N.^o 2) is subdivided into.

N.^o 2 a — Lightly tainted.

N.^o 2 b — Badly tainted.

N.^o 2 a is cream affected by food taints, slight biological taints, or by a combination of both.

N.^o 2 b is a cream affected by advanced biological taints, but which has not reached the putrescent stage.

Clause 13 forbids the use of putrescent cream for making butter, and

prescribes that it shall be treated with such substances as shall not destroy their value as animal food. It may be returned to the supplier.

A clause which protects the cream supplies obliges the managers of factories to send every month to the Under Secretary of the Department of Agriculture a statement of the quantity of each grade of butter made in his factory, and the quantity of butter which the suppliers of cream have been paid for.

Butter may not be exported without being graded. If its grade is found to be different from that indicated by the registered brand on the package, it may not be exported under that brand. A certificate of grading shall be supplied to the manufacturer and the exporter.

All butter, cheese and margarine factories must register under the Act and all stores.

A store is defined as a place where condensed milk, butter, cheese or margarine is stored whether in a cold chamber or otherwise, but does not include premises used for the sale by retail of such dairy produce. But if a retailer stores butter in quantity on this premises, such store could not be included as a retail section, and therefore would have to be registered.

Anyone keeping dairy produce where it may deteriorate owing to heat, bad smell or the proximity of unclean matter is liable to a penalty not exceeding £. 20. This applies more particularly to cream and butter which are more sensitive to their surroundings than cheese.

The butter merchants of Sydney have decided to store their butter in a cold store during the night.

9 - Investigations on the Protease of Milk Bacteria. — SWIATOPIELK-ZAWADSKI, in *Zeitschrift für Untersuchung der Nahrungs- und Genussmittel, sowie der Gebrauchsgegenstände*, Vol. 32, No. 4, pp. 161-170, Münster i. W., August 15, 1916.

A series of very careful experiments were carried out on the production protease by milk bacteria. The results are discussed and compared with those obtained by other investigators, and the following conclusions are arrived at:

- 1) Pure fresh milk contains no peptone.
- 2) True lactic acid bacteria do not dissolve casein within a period of 7 days, i. e. they do not produce protease.
- 3) The presence of peptone in a self coagulated milk can only be attributed to the presence of peptonising bacteria.
- 4) The decomposition of casein and other albuminoid substances only occurs through the agency of bacteria.
- 5) The rate at which the albuminoids are converted to peptones increases with the temperature up to 44° C.
- 6) Proteolytic ferments may be produced by aerobic and anaerobic bacteria, both spore-forming and non spore-forming.

In the present experiments the most active aerobic bacteria were *cillus psychrancus* (after 6 hours), *Bac. prodigiosus* (after 18 hours) and *c. coli commune* (after 24 hours); and amongst the spore-formers *Bac. suis* (after 6 hours) and *Bac. mesentericus vulgaris* (after 18 hours).

The most active anaerobic bacterium was the spore-forming *Paraplectus foetidum* (after 24 hours).

7) The amount of peptone produced and the rate at which it is formed vary not only with the different species but often with different strains of the same species (e. g. *B. subtilis*).

8) The hydrolysis of casein can take place independently of the coagulation of milk, which does not even assist the process.

9) In the present experiment neither the amount of peptone produced nor its rate of production by aerobic bacteria was affected by the presence of other bacteria in the medium. At about 12° C. the activity of protease is always somewhat retarded. Sterilized milk inoculated with pure cultures of various organisms and incubated at 12° C. already contained peptone after 8 hours with *B. pyocyanus* and *B. subtilis* and after anything up to 14 days with *B. coli commune*, *B. prodigiosus*, *B. paraplectus foetidum*, *B. mesentericus vulgatus* or in other words the presence of *Lactobacilli* in the unsterilized milk had no appreciable effect on the results.

1220 - The Supply of Rennet for Cheese Making in Italy (1). — I. BISANA, C., (The lack of coagulating ferment for the cheese factories). — II. FASCIANI, G., (How to supply the necessary amount of rennet.) in *Le Stazioni sperimentali agrarie italiane*, Vol. MD, No. 1, pp. 10-12 and 13-16. Modena, 1916.

In Italy the slaughter of calves weighing less than 400 lbs. is prohibited. Consequently the stomachs of calves nourished wholly on milk in other words those best adapted to the manufacture of rennet are excluded from the market. At the present time, imports of dried stomach from European countries have almost ceased and it seems uncertain how far it will be possible to obtain the material from elsewhere. Normal 45-50 tons of rennet are used annually in the Italian cheese factories and of this about one half is imported abroad. Under these circumstances it is essential that Italy should take steps to prevent a shortage of rennet in the country. To this end it is suggested:

1) That the available calves' stomachs be more completely extracted and that the use of lambs' and kids' stomachs be encouraged and developed. The latter are already employed in the manufacture of « pecorino » cheese but only to a very slight extent.

2) That the preparation of a vegetable rennet from the capituli of the cardoon (*Cynara Cardunculus*) be encouraged. This plant grows widely in central and southern Italy and might well be cultivated for rennet production.

3) That an attempt be made to produce coagulating enzymes from bacterial cultures.

1221 - The Abnormal Composition of Fat in a Pig, Fed on Maize. — RIEVER, in *Zeitschrift für Untersuchung der Nahrungs- und Genussmittel, sowie der Gebrauchsgegenstände*, Vol. 1, No. 4, pp. 178-181. Münster i W., August 15, 1916.

The fat on the carcase of a seven months old pig was found to be quite abnormal. It was firm, opaque, almost dead white and chalky when fresh.

(1) See *B. Feb. 1916*, No. 233.

On being melted out it solidified very quickly forming a greyish lard with a very smooth even surface which did not show the usual depression in the middle with concentric rings radiating outwards. The lard was hard and cut like paraffin. Its constants were determined and compared with those of other fats as follows:

	Abnormal lard	Normal lard	Mutton fat	Venison fat
idifying point °C	46.9	37.2-39.8	34.45	40.05
ting point °C	56.5	26.5-28.6	49.25	51.50
ability per 100 parts chloroform at 17°C	80	100	71	71
active index at 40°C	43.9	50.6-50.9	46.85	44.75
active index of chloroform solution at 17°C	41.9	46.1-47.5	47.45	40.55
onification value	159.9	196-198	196	—
chert-Meisel value	2.5	0.3-0.9	0.25	—
ine value	23.6	46-47	40	—
per cent	1.24	traces	—	—

The fat differed so markedly from ordinary lard that it could not be signified as such. It more closely resembled mutton or venison fat. The writer suggests that the abnormal character of the lard was due to the fact that the animal had been fed for a long time on damaged maize. As a rule maize diet causes the production of a soft and oily fat but in the present case opposite effects were observed and these can only be explained on the assumption that the prolonged feeding with the damaged maize resulted in grave metabolic disturbances in the pig and that these interfered with the deposition of fat.

2-The World's Sheep and their Wool with Special Reference to the Production in Australasia.—*Dalyell's Review, Annual Wool Number, Year XXIV, No. 4, pp. 36-126.* Sydney, July, 1, 1916.

The National Association of Wool Manufacturers in America has issued two tables in which are given the latest figures for the total number of sheep in the world, and for the world's production of wool. They cannot of course be taken as exact statements for in some cases the figures refer to pre-war periods; they are merely meant to give an approximate idea of the situation. The tables are as follows:

TABLE I. — *Distribution of sheep in the world.*

Country	Year	Number
North America:	—	—
United States Continental	1915	49 956 000
Hawaii	*	76 719
Porto Rico	*	6 363
Alaska	*	199
Total, United States		50 039 281

Canada	1915	2 938 662
Newfoundland	—	97 597
Mexico	1902	3 424 439
Central America	—	124 044
Cuba	—	9 982
British West Indies	—	27 989
Dutch West Indies	—	22 613
Guadeloupe	—	11 731
		5 757 069
Total, North America		55 796 350
<i>South America:</i>		
Argentina	1912	83 515 931
Brazil	1913	10 653 000
Bolivia	1910*	1 454 729
Chili	1914	4 602 317
Colombia	—	749 000
Uruguay	1908	26 286 296
Falkland Islands	—	711 000
Other countries	—	407 000
		128 406 273
<i>Europe:</i>		
Austria-Hungary	1910-13	12 337 867
Belgium	—	235 722
Bulgaria	1910	8 632 388
Denmark	—	1 319 197
Finland	—	1 309 000
France	1915	13 483 189
Germany	1914	5 451 570
Greece	—	4 000 000
Italy	1908	11 162 926
Netherlands	—	842 000
Norway	—	1 303 000
Portugal	1906	3 077 978
Roumania	1911	5 269 493
Russia in Europe	1911	46 381 000
Saxony	—	58 185
Serbia	1910	3 818 997
Spain	1913	16 441 407
Sweden	1911	9 46 000
Switzerland	1911	160 000
Turkey	1910	21 150 000
United Kingdom	1915	27 552 136
Other countries	—	20 000
		185 077 065
<i>Asia:</i>		
British India:		
British provinces	1914	23 091 055
Native States	*	8 129 000
		31 220 955

Ceylon	1912	91 000
Cyprus	1912	256 000
Japan	1912	3 357
Philippine Islands	1913	103 000
Russia in Asia	1911	34 493 000
Turkey in Asia	1912	27 094 678
Other countries	—	60 000
Total, Asia excluding India . . .		62 101 035
<i>Africa:</i>		
Algeria	1912	8 338 023
British East Africa	—	6 500 000
German East Africa	1913	6 439 647
German West Africa	1912	499 000
Madagascar	1911	352 000
Rhodesia	1911	309 000
Sudan (Anglo-Egyptian)	1909	830 000
Tunis	1912	767 000
Uganda	1914	542 000
Cape of Good Hope	—	
Natal	—	
Orange Free State	—	
Transvaal	1913	35 710 843
Other countries	—	4 130 535
Total, Africa . . .		64 408 848
<i>Oceania:</i>		
Australia	1915	82 011 666
New Zealand	1915	24 365 526
Total, Australasia . . .		106 477 132
Other countries		10 000
Total, Oceania . . .		106 487 132
Total, World . . .		633 497 658

The remarks made in the introduction apply with even more force to world's wool production. Reliable statistics are available for the United States, Australasia and British South Africa. In other countries quantities reported the previous year are used, and in some cases where report of the number of sheep has been materially altered, the quantity records have been modified accordingly. There is an apparent anomaly in the increase in the number of Argentine sheep reported and the steady decrease of wool exports. In 1907 the Argentine census reported 200 000 sheep; more recent estimates increase the number of Argentine sheep to 83 545 931. At the same time the wool exports have decreased from 178 000 metric tons in 1907-1908 to 120 000 in 1913-1914. The National Association puts forward the suggestion that the census report included shearing sheep only and made no account of lambs, and that later reports included both sheep and lambs. In the absence of official Ar-

gentine returns the sheep figures are presented with this suggestion. The wool production of the world is given below.

TABLE II. — *Wool production of the world.*

Country	Lbs. of wool
<i>North America :</i>	
United States	288 777 000
British Provinces	11 210 000
Mexico	7 000 000
Total, North America	306 987 000
<i>Central America and West Indies</i>	
	<i>750 000</i>
<i>South America :</i>	
Argentina	264 500 000
Brazil	35 000 000
Chili	17 000 000
Peru	9 420 707
Falkland Islands	3 200 000
Uruguay	143 293 000
Other countries	5 000 000
Total, South America	777 413 707
<i>Europe :</i>	
Austria-Ungary	41 600 000
France	75 000 000
Greece	16 000 000
Germany	25 600 000
Portugal	10 000 000
Italy	21 500 000
Russia in Europe	320 000 000
Spain	52 000 000
Turkey and Balkan States	90 500 000
United Kingdom	121 200 043
Other countries	36 000 000
Total, Europe	803 400 043
<i>Asia :</i>	
British India	60 000 000
China	50 000 000
Persia	12 116 000
Russia in Asia	60 000 000
Turkey in Asia	90 000 000
Other countries	1 000 000
Total, Asia	273 146 000
<i>Africa :</i>	
Algeria	33 184 000
British Africa	157 761 470
Tunis	3 735 000
Other countries	13 000 000
Total, Africa	207 680 470

Oceania:

Australia and Tasmania	569 775 000
New Zealand	197 866 914
	767 841 914
Other countries	100 000
Total, Oceania	767 141 914

Total, World **2 836 519 000**

Summarising, the various parts of the world in order of production as follows :

	Lbs. of wool
Europe	803 400 643
America	785 150 707
Oceania	767 141 914
Asia.	273 146 000
Africa	207 680 470

Australasian production of wool. — The oversea export of wool during the statistical year ended June 30 amounted to 1 619 259 bales from the Australian Commonwealth and 510 656 bales from New Zealand, the former being an increase of 43 571 bales as compared with the preceding season and the latter a decrease of 51 358 bales. These figures do not, however, provide anything like a true index of the state of production in the past season, because of the heavy carry-over of 1914-1915 clip-ols (approximately 200,000 bales) to the 1915-1916 season while there remained unshipped on June 30 about 65 000 bales. The actual production of wool in Australia for export during the 1915-1916 season can therefore be set down as 1 484 000 bales as compared with 1 775 000 bales in 1914-1915. For New Zealand the corresponding figures are 510 656 and 2014 respectively. Adding together the Commonwealth and New Zealand figures, a total Australasian production of 1 994 656 bales is obtained compared with 2 337 014 bales for the previous season (or a decrease of 342 014 bales). Taking the comparison back two seasons, the figures show a falling off in production for export of 532,807 bales since 1913-1914.

The 1 994 656 bales produced averaged 3 227 lbs. in weight, so that the actual wool output for 1915-1916 was 654 032 880 lbs. The distribution of the output is given in Table III. As special features of the season, may be pointed out that America, Italy and Japan purchased large quantities of wool while the United Kingdom only took 41 per cent of the total sales as against 64 per cent the previous year. The financial statements of the sales in the different markets were as follows :

Market	No. of bales	Value £
Sydney	707 969	10 429 770
Melbourne and Geelong	349 984	5 632 152
Adelaide	115 314	1 525 972
Freemantle	1 459	16 527
Brisbane	246 376	4 279 498
Tasmania	22 016	393 643
New Zealand	364 861	7 715 970
Australasia	1 807 979	29 903 532
Average price per bale £16 10s 1d (1).		

The gross revenue as shown above exceeded that of 1914-1915 by ten million sterling.

The 1914-1915 clip was characterised by a rise in the proportion of crossbred to merino wool and in this connection it is interesting to contrast the clips over a period of 5 years. At Melbourne in 1911-1912, 56 per cent of the wool sold consisted of merino, the rest being crossbred, but 1915-1916 the percentage had been reduced to 48. At Geelong over the same period the reduction was smaller *i. e.* from 51 to 49 per cent. The increasing amount of crossbred wool on the market is attributed to the growth of the frozen meat trade which is gradually causing the pure merino flocks to be replaced by general purpose sheep *i. e.* sheep which are more suitable for the production of mutton though their fleece may not be quite so fine as that of the merino. Nevertheless in Queensland the merino is still likely to hold its own, as the recent drought there has demonstrated clearly the special hardiness of the Peppin and South Australian types and has made owners less anxious to try experimental crosses with English breeds. With regard to the demand for the two classes of wool, the war has caused an unprecedented run upon the coarser kind to supply the army clothing departments. America has on the other hand been a keen buyer of the finer types.

A comparison of the average weight of fleeces for the last three seasons is given below:

No. of fleeces per bale	Average weight of bale
1913-1914	41.56
1914-1915	43.97
1915-1916	44.31

These figures are not altogether a true indication of how the sheep are cutting as the weight of the bales varies and shows a tendency to become lighter. From the above figures the mean yield per sheep for 1915-1916 and 1914-1915 was 7.28 and 7.41 lbs. respectively.

The top prices made in any one year on the Australian markets have

(1) Corresponding figures for 1913-1914 were: 2 527 463 bales for a gross value £33 478 353 or £13 4s 1d per bale.

been collected in Table IV and show how the figures for 1915-1916 completely put all previous records in the shade. Table V indicates the course of quotations for the various qualities since 1910.

There is every indication that the clip for the present season will be larger than that for 1915-1916. The flocks are everywhere in good condition and the owners look forward to a yield of heavy fleeces.

TABLE III. — *Destination of exports of Australasian wool (1914-1915 and 1915-1916).*

Destination	1915-1916		1914-1915	
	No. of bales	Per cent of total export	No. of bales	Per cent of total export
United Kingdom	742 178	41	983 355	64
France	57 345	3	58 706	4
Belgium and Netherlands	—	—	5 459	—
Germany and Austria	—	—	8 439	1
Italy and Switzerland	166 916	10	68 436	4
Russia, Norway and Sweden	7 422	—	1 466	—
United States and Canada	564 433	31	234 896	15
Japan, China and India	113 611	6	81 890	9
Australasian manufacturers	156 074	9	102 152	7
	1 807 979		1 544 799	

TABLE IV. — *Top prices made for wool in the Australasian markets (pence per lb.)*

Year	Greasy fleece		Scoured fleece	
	Merino	Crossbred	Merino	Crossbred
1915-1916	24 $\frac{3}{4}$	23 $\frac{1}{4}$	44 $\frac{1}{2}$	27
1914-1915	18 $\frac{3}{4}$	18	28	22 $\frac{1}{4}$
1913-1914	20 $\frac{1}{4}$	15	28	20 $\frac{3}{4}$
1912-1913	19 $\frac{1}{4}$	15 $\frac{3}{4}$	26 $\frac{1}{2}$	20 $\frac{1}{2}$
1911-1912	18 $\frac{1}{2}$	14 $\frac{3}{4}$	24 $\frac{3}{4}$	17 $\frac{3}{4}$
1910-1911	18 $\frac{1}{4}$	15 $\frac{1}{4}$	24 $\frac{1}{2}$	20
1909-1910	21	18 $\frac{1}{4}$	25 $\frac{1}{4}$	20 $\frac{1}{2}$
1908-1909	19	15 $\frac{1}{2}$	23 $\frac{3}{4}$	16 $\frac{1}{2}$
1907-1908	20 $\frac{1}{2}$	17 $\frac{1}{2}$	27 $\frac{1}{4}$	23 $\frac{1}{4}$
1906-1907	18 $\frac{1}{4}$	17 $\frac{1}{2}$	25	22 $\frac{1}{2}$

TABLE V. — Quotations for tops on the Australasian markets at June, 30th
(pence per lb.).

Counts (1)	1909	1910	1911	1912	1913	1914	1915
70's (fine quality merino)	28 1/2	29 1/2	28	27 1/2	31 1/4	32 1/2	46
Super 60's (good merino)	26 1/2	28	26 1/2	25 1/2	29 1/4	30 1/2	41 1/4
Common 60's (ordinary merino) . .	25 1/2	27	25 1/2	25	29	30	43
58's (coarse merino fine comeback) .	24	25 3/4	23 1/2	22 1/2	26	26 1/2	40
56's ('c'b'k fine xb.)	21 1/2	23 1/2	21 1/2	20 1/4	23 3/4	23 3/4	36 1/4
50's (fine quality xb.)	18 1/4	20 3/4	18 1/2	17 3/4	21 1/4	20 1/2	33 1/2
46's (medium quality xb.)	15	16 3/4	15 1/4	14 1/4	17 1/2	17 1/4	28
44's (rather coarse xb.)	14	15 3/4	14 3/4	14	16 1/2	16 3/4	27
40's (coarse quality xb.)	12 3/4	14 1/4	14 1/4	13 1/2	16 3/4	16 1/2	26
36's (Lincoln and Leicester) . . .	12	13 1/4	13 1/2	13 1/4	16	16 1/4	25

(1) The « count » number was originally used to indicate the number of hanks of 560 yds per lb. of worsted yarn. For example:

lb. of 40's worsted yarn contained $40 \times 560 = 22400$ yds. of worsted

* 60's * * * 60 $\times 560 = 33600$ *

But in actual practice the count number represents the fineness of the fibres rather than the yield of hanks per lb. In fact the yarn may be classed as 60's for the thickness of its fibres even if it only yielded 50 hanks per lb. on account of the lack of length and uniformity in the fibres.

1223 — New and Quick Method of Determining the Age of Eggs. — GROSSFELD, in *Merkel-Zeitung*, Year 30, No. 33, pp. 515-517. Hildesheim, August 18, 1916.

A new method has been devised for estimating the age of eggs. It is based on the fact that a new laid egg is heavier than water and that gradually loses weight as its age advances. The weight of an average size fresh egg in water is 4.3 gms. and decreases at the rate of 0.6 gm. per week so that after about seven weeks the egg is of exactly the same density as water and then its weight gradually passes into minus values, as the egg reaches advanced stages of preservation.

By means of a simple areometer, the weight of the egg in water can be determined very quickly. The instrument is made by HUGERSON & GUERBER AND CO., Leipzig and consists of a graduated tube with a metal basket at its base. Having placed the egg in the basket, the whole instrument is immersed in the coldest water available and the weight of the egg in water as well as its age in weeks can be read off directly from the graduations. The whole operation only takes a few seconds so that a large number of eggs can be tested in a short time.

Though the instrument is calibrated for an egg weighing 54.3 gm. and occupying a volume of 50 cc., i. e. for an average sized egg, the readings are sufficiently correct for practical purposes with all but very small

very large eggs. Where however a greater degree of accuracy is required the error due to the size of the egg can be eliminated as follows: the weight of the egg in water is divided by its weight in air and multiplied by 100. The resulting figure is about 8 for a new laid egg and decreases at the rate of 1 per week as the age of the egg advances. For example:

An egg weighing 2 gms. in water and 60 gms. in air would be $8 - \frac{2 \times 100}{60} = 8 - 3.3 =$
when 4 and 5 weeks old.

The areometer also affords an easier means of determining the specific gravity of eggs than by the use of saline solutions. With the figures given above,

$$\begin{aligned}\text{Specific gravity of egg} &= \frac{\text{weight in air}}{\text{weight in air} - \text{weight in water}} \\ &= \frac{60}{60 - 2} \\ &= 1.034.\end{aligned}$$

24-A Study of the Preparation of Frozen and Dried Eggs.—PENNINGTON M. E., JENKINS M. K., STOCKING W. A., et al. in *United States Department of Agriculture, Bulletin No. 224*, pp. 1-99. Washington, April 28, 1916.

In Bulletin No. 51 (*U. S. Dep. of Agr.*) a report has already been made of the various types of eggs used in the preparation of frozen and dried eggs in the egg-producing districts of the United States. It was shown that in order to obtain the best results a certain proportion of eggs should be treated as «liquid eggs», i. e. without their shells. A study of the conditions prevailing in the egg-breaking establishments was next undertaken in cooperation with the factories themselves, the results of which are set forth in the present paper. The body of the bulletin gives an outline of the work done and the conclusions which should be of general interest to all connected with the industry. In the appendix are given details of the experiments which may be of use to managers of factories and to chemists and bacteriologists engaged in food investigations.

This report is based on observations made in establishments scattered between northwestern Iowa and central Kansas, during the seasons 1911 and 1912. Tables I and II give a general summary of the results of the bacteriological and chemical examinations of various grades of liquid eggs in three of the factories (D, E, and F.) The grades of eggs mentioned are:

- «whole eggs» = eggs merely deprived of their shells.
- «mixed eggs» = a product prepared by adding yolks to whole eggs.
- «leakers» = eggs with shell and inner membrane broken.
- «soft eggs» = eggs whose yolk appears whole before the candle but which breaks when opened.
- «second grade eggs» = a product prepared from «drip» and incipient forms of deteriorated eggs.
- «tanners' eggs» = is a product made from the rejects of the candling and breaking rooms excluding eggs with a bad odour. It is used for tanning leather.
- «drip» = is the liquid egg, mostly white, which collects in the bottom of the breaking tray.

TABLE I. — *Bacterial counts on liquid eggs.*

Description of sample	No. of samples	Samples with over 5 000 000 bacteria· per gm.	No. of organisms per gm.		
			Average	Minimum	Maximum
		per cent			
Whites	39	2.6	350 000	100	7 500 000
Yolks	54	5.6	530 000	200	7 500 000
Whole eggs	47	21.3	2 700 000	340 000	11 000 000
Mixed eggs from D house.	46	0	1 000 000	5 100	3 300 000
" " F "	12	8.3	1 700 000	470 000	6 800 000
Leaking eggs	53	5.9	1 300 000	500	6 000 000
Soft eggs	13	46.1	20 000 000	130 000	80 000 000
Second-grade eggs	14	92.8	35 000 000	4 200 000	92 000 000
Tanners' eggs	10	100	76 000 000	31 000 000	150 000 000

TABLE II. — *Chemical tests on liquid eggs.*

Description of sample	No. of sam- ples	Ammoniacal nitrogen						Percentage of moisture		
		Per 100 parts wet weight			Per 100 parts dry weight			Ave- rage	Min.	Max.
		Average	Min.	Max.	Average	Min.	Max.			
Whites	13	0.0004	0.0002	0.0006	0.0031	0.0016	0.0049	87.37	86.96	88.5
Yolks	23	0.0032	0.0024	0.0045	0.0076	0.0054	0.0103	57.88	33.64	44.4
Sugared yolks	7	0.0030	0.0028	0.0033	0.0062	0.0058	0.0067	51.12	49.89	53.4
Whole eggs	43	0.0021	0.0016	0.0024	0.0074	0.0054	0.0087	72.33	70.13	74.4
Mixed eggs from D house	34	0.0020	0.0014	0.0025	0.0067	0.0046	0.0082	68.88	68.33	74.4
Mixed eggs from P house	10	0.0023	0.0017	0.0027	0.0071	0.0053	0.0082	68.06	67.00	70.8
Leaking eggs	37	0.0020	0.0013	0.0028	0.0065	0.0047	0.0080	66.63	64.12	72.8
Soft eggs	11	0.0023	0.0018	0.0031	0.0080	0.0066	0.0098	71.24	67.04	74.4
Second-grade eggs and drippings	14	0.0024	0.0008	0.0040	0.0068	0.0052	0.0182	78.20	71.79	84.8
Tanners' eggs	9	0.0041	0.0021	0.0069	0.0133	0.0074	0.0219	69.98	65.06	71

The average number of bacteria per gm. in the whites was 350.00 in the yolk 530 000 and in the whole and mixed eggs 1 800 000. The average amount of ammoniacal nitrogen was 0.0031 per cent of the dry matt in the whites, 0.0076 per cent in the yolks and 0.0074 per cent in the whole eggs. A comparison of these results shows that the average count of the whites is about half that of the yolks and that the latter contained approximately one third as many bacteria as the whole and mixed eggs. The antiseptic action of the white may explain its lower bacterial content as compared with that of the yolks, whole eggs and mixed eggs. It ma

that the presence of soft eggs in the whole and mixed eggs offers also explanation of their higher bacterial content.

It is interesting to note that the average count of the product prepared in leaking eggs is not different from that of whole and mixed eggs. The average count of the former was 1,300,000 and for the latter 1,800,000. The amount of chemical decomposition was no greater in the leaking eggs than in the whole and mixed eggs.

The product prepared from soft eggs graded as fit for food purposes contained decidedly more bacteria than the whole or mixed egg, but the counts of ammoniacal nitrogen in the two were not so very far apart. The average number of organisms in the soft eggs numbered 20,000,000 per gram, as compared with 1,800,000 in the whole and mixed egg, whereas the percentage of loosely bound nitrogen averaged 0.0080 in the former and 0.0074 in the latter. The bacteria in the soft eggs were not present sufficient numbers or for a sufficient length of time to affect a decomposition of the egg material. On the other hand the second grade frozen eggs prepared from "beginning sour," (i. e., eggs with light-green whites) the tanners' eggs were not only heavily infected but were decomposed. The average number of bacteria in the former was 35,000,000 per gm. and in the latter 76,000,000. The amount of ammoniacal nitrogen was 10.8 per cent in the second-grade egg and 0.0133 in the tanners' eggs. These comparative data, together with the practical observations of the persons used in the former product, show very conclusively that second-grade frozen or dried eggs are unfit for food purposes.

As the houses under observation during 1912 were three of the largest producers of canned and dried eggs in the United States, it is instructive to compare the quality of their output as indicated by its bacterial content with that offered for sale for food during the two years previous to the investigation. STILES and BATES (*Bureau of Chemistry, U. S. Dep. of Agriculture, Bulletin No. 158*) found in a study of 312 samples of frozen eggs selected from different sources during the years 1909 to 1911, inclusive, that 58.3 per cent contained over 10,000,000 bacteria per gram. Of 216 samples of liquid eggs obtained from the cooperating houses during this investigation in 1912, only 1.4 per cent were found to contain over 10,000,000 per gram. The maximum count in the three houses in 1912 was 11,000,000 per gram, while the maximum found by Stiles and Bates was 1,180,000,000.

The difference in the bacterial count of the samples of dried eggs was not as marked. Stiles and Bates found that 83.3 per cent of the samples obtained on the open market contained over 10,000,000 per gram. Only 1.4 per cent of 46 samples taken in E house contained over this number, while in F house 55.3 per cent of the samples were in excess of 10,000,000. The maximum number per gram found in the samples of dried eggs taken in 1912 was 20,000,000 for E house and 200,000,000 for F house, and in the samples collected between 1909 and 1911 by Stiles and Bates 210,000,000. It is known in the case of F house that the raw material was of good quality and that the bacteria increased during desiccation.

The samples studied by Stiles and Bates represented not only frozen

and dried eggs prepared from good eggs by the best methods known at the time, but also products made from unfit raw material. These comparative data speak well for the quality of the product prepared by the methods in the three houses under investigation.

CONCLUSIONS.

- 1) Eggs commonly used for breaking stock by reputable firms are small and oversized eggs, dirty and cracked eggs, and shrunken eggs.
- 2) In order to check deterioration, the eggs should be held in chilled surroundings before and during the process of candling, breaking, and mixing preparatory to freezing or drying. The temperature of the store room should not be higher than 0° to 10° C., that of the candling room 10° to 13° C., that of the breaking room 15° to 18° C.
- 3) All eggs, even during the spring months, should be candled previous to breaking.
- 4) In order to insure well candled eggs going to the breaking room the system of candling should be such that the work of the individual candlers is checked.
- 5) In order to prevent waste, the eggs difficult to grade should be set aside by the regular candlers to be recandled by an expert.
- 6) All eggs used in the preparation of frozen and dried eggs should be graded out of the shell as well as by the candle, because certain heavily infected eggs, such as sour eggs and eggs with green whites, can only be detected when broken.
- 7) In order to insure a good product, bacterial cleanliness and careful grading must be obtained during the process of preparation.
- 8) The fingers of the breakers should be kept dry and clean.
- 9) In order to prevent waste and to insure good grading, not more than three eggs should be broken into a cup before emptying.
- 10) Good eggs should not be saved when a bad egg has been broken into a cup with them.
- 11) White and yolk are contaminated less by the mechanical than the shell method of separation. Only clean eggs should be separated in the latter process.
- 12) The percentage of «rots» rejected on candling and the number of organisms in the liquid egg increase as the season advances.
- 13) Canned eggs with the majority of samples having counts less than 5 000 000 bacteria per gram, and with 100 000 *B. coli* or less, be prepared in the producing section from regular breaking stock, providing strict cleanliness and careful grading have been observed. The ammonia nitrogen will very seldom be over 0.0087 per cent of dry matter.
- 14) A second-grade frozen product prepared from eggs showing incipient decomposition to the senses, such as «beginning sours» and eggs with green whites are not only heavily infected but chemically decomposed. These eggs are unfit for food purposes.

- 15) Only two grades of canned eggs should be prepared when grading it of the shell, namely, food egg and tanners' egg.
- 16) Leaking eggs handled on special trays between candling and in room and graded carefully are as fit for breaking as regular ng stock. *
- 17) Tanners' egg contains markedly larger numbers of bacteria rger amounts of ammoniacal nitrogen than does food egg.
- 18) The control of the supply of air to drying belts to prevent sa m from the liquid egg is an important factor in preventing multi on of bacteria in the product during the process of desiccation.
- 19) The amount of ammoniacal nitrogen in desiccated egg is not le index to the quality of the raw material from which it is prepared, this substance is volatilized unevenly during the process of de n.
- 20) The following eggs should be discarded during grading : Black, mixed and sour «rots», eggs with green whites, eggs with stuck musty eggs, mouldy eggs, «blood rings», eggs containing diffuse and eggs with abnormal odour.

PLANT DISEASES

DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN.

1225 - Mottle-Leaf of Citrus Trees in Relation to Soil Conditions. — LYMAN, J., B. J. C. A., and Mc LANE J. W., in *Journal of Agricultural Research*, Vol. VI, No 10, pp 739, Pl. XCVII. Washington, D. C., 1916.

Mottle-leaf of Citrus trees is characterised by the disappearance of chlorophyll from parts of the leaf beginning at the points which are furthest away from the mid-rib and the larger veins. As the disease progresses the yellowish spots increase in size, and finally unite, until only remaining chlorophyll is confined to narrow areas along the veins. In advanced stages there is a marked decrease in the size, quality and yield of the fruit. No organism has as yet proved to be associated with this condition, but it is generally stated that the nematode *Tylenchus semipenetrans* Cobb (1) is widely distributed in districts infected with mottle-lead.

Mottle-leaf is found in most Citrus fruit plantations in California but it is more prevalent in some districts than in others. All the Citrus fruits grown in California are affected, including the Washington Navel, Thompson Improved Navel, and Valencia orange, grapefruit, tangerine and lemon.

Other conditions being equal, the buds grafted on to *C. aurantium* are more susceptible than those grafted on to *C. sinensis*; in a grove of Washington Navel and Valencia oranges both varieties are equally attacked.

Orchards manured with organic substances, such as stable manure or clover crops, usually did better than those treated with chemical fertilisers. In the latter case the changes induced are always more extensive than when nitrate of soda alone is employed.

The experiments in question indicate that the origin of the disease must be sought in the conditions of growth and more especially in

(1) See *B.* July 1915, No. 776.

chemical composition of the soil. The conclusions are based upon a field laboratory study of 130 orange groves and 45 lemon groves mainly located in Riverside and San Bernardino Counties, California. The percentage of mottled leaves was determined by examining 10 to 12 typical trees in each grove. A soil sample 3 feet in depth was taken near each tree, a foot sample being kept separately. These samples were analysed, humus, organic carbon, mineral carbonates, bicarbonates and total nitrogen. The most striking results are shown in Tables I and II.

The moisture equivalent is a measure of the moisture retentiveness of soil, and is numerically equal to the percentage of moisture which the soil is able to retain in opposition to a centrifugal force 1000 times that of gravity. The finer the soil particles the greater is the moisture equivalent.

The following facts can be gleaned from tables I and II:

TABLE I. — *Analysis of orange grove soils, grouped according to percentage of mottled leaves, each group containing about 20 groves.*

Humus	Percentage of —				Ratio of —				Moisture equivalent	Mottled leaves
	Total nitrogen	Organic carbon	Mineral carbonates	Mineral bicarbonates	Humus to lime	Carbon to humus	Nitrogen to humus	Nitrogen to carbon		
0.119	0.036	0.237	0.069	0.023	1.72	2.50	0.303	0.152	11.3	88
0.142	0.036	0.256	0.066	0.024	2.15	1.54	0.254	0.141	12.4	64
0.170	0.039	0.254	0.093	0.026	1.83	1.67	0.229	0.154	11.6	43
0.165	0.039	0.255	0.080	0.027	2.06	1.65	0.237	0.153	12.6	19
0.244	0.039	0.261	0.068	0.020	3.59	1.93	0.159	0.149	11.9	8
0.204	0.038	0.263	0.079	0.028	2.58	1.78	0.186	0.144	12.8	1

TABLE II. — *Analyses of lemon grove soils, grouped according to percentage of mottled leaves, each group including 8 groves.*

Humus	Percentage of —				Ratio of —				Moisture equivalent	Mottled leaves
	Total nitrogen	Organic carbon	Mineral carbonates	Mineral bicarbonates	Humus to lime	Carbon to humus	Nitrogen to humus	Nitrogen to carbon		
0.066	0.036	0.241	0.062	0.023	1.06	2.74	0.545	0.149	10.1	92
0.081	0.033	0.258	0.050	0.024	1.64	3.18	0.407	0.128	10.6	87
0.087	0.037	0.265	0.073	0.029	1.19	3.05	0.425	0.139	11.8	82
0.072	0.033	0.237	0.097	0.029	0.74	3.29	0.458	0.139	11.0	76
0.070	0.033	0.253	0.089	0.029	0.79	3.61	0.471	0.126	11.8	58

The results of the soil analyses show that in the case of the orange there is a marked inverse correlation between the humus content of the soil and the percentage of mottling, the latter tends to diminish as the humus content increases. A statistical study of the data shows that 50 per cent of the cases of mottling can be accounted for by the low humus content of the soil. The humus content of the lemon soils studied averages 0.1 per cent, an amount which is too small to produce a normal growth, and which is nearly always associated with mottling.

No correlation was found between the proportion of mineral carbon in the soil and mottling; it was noticed that in lemons the mottling decreased slightly as the mineral carbonates increased, but the changes were so slight that it cannot really be considered as a case of correlation. In the soils examined the lime content is low, and its application in large quantities benefits lemon trees more than orange trees, more especially when the soil is rich in humus.

There is no relation between the total nitrogen and mottle-leaf disease in oranges or in lemons. The greater the proportion of organic carbon with regard to the humus, the more the leaves of the tree are attacked and in the same way, the more proportion of humus is raised the more the disease is checked. This does not prove that humus is the organic substance best fitted to give rise to the development of healthy and normal leaves, but it shows that in a soil which is able to convert organic matter into humus, the organic matter, during the process of decomposition, passes through stages when it is very readily absorbed by the plant root. Addition of organic substances which can readily be assimilated to soil is therefore suggested as a new means of checking the attacks of mottle-leaf.

DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS.

GENERALITIES

1226 - Climatic Conditions as related to *Cercospora beticola*. — POOL, V. W., MC KAY, M. B., in *Journal of Agricultural Research*, vol. VI, n. 1, pp. 21-60, fig. Pl. III-IV. Washington, D. C., 1916.

Experimental work on the subject in hand leads to the following conclusion:

1) The life of the fungus *Cercospora beticola* wintering in sugar-beet top material varies according to the environment. When exposed to outdoor conditions the conidia die in one to four months; but when kept dry they live as long as eight months. The sclerotia-like bodies, which are more or less embedded in the tissues of the host, are more resistant than the conidia, living through the winter when slightly protected, for example in the interior of a pile of sugar-beet tops or buried in the ground at a depth of 1 to 5 inches, and become a source of infection for the succeeding crop. Notwithstanding the difference in temperature and soil moisture con-

ons similar results were obtained from wintering experiments at Rocky
ord, Colorado and Madison, Wisconsin.

2) Climatic conditions and the development of the leaf spot can only
e correlated when all records are taken at the same relative positions,
; shown by comparison of the Weather Bureau records and the records
ken among the plants and 5 feet above the field.

3) The maximum temperature early in the season is much higher
ear the ground than it is 5 feet above, but the difference diminishes as
e season advances.

4) Throughout the season the maximum humidity was higher among
leaves than 5 feet above the field. Early in the season while the plants
ere small the humidity remained above 60 longer each day at 5 feet above
e field than among the plants near the ground; but after the plants
tained a good size this condition was reversed. Because of this difference
y records collected among the leaves should be considered in correlating
climatic conditions and conidial production and infection.

5) The effect of rainfall and irrigation on the increase of relative
humidity and its duration is apparently much the same.

6) Thermal tests with artificial cultures showed that:

a) exposure to constant temperatures of 35° and 36° C. is fatal to
the growth of the fungus;

b) growth occurred when cultures after exposure for 3 days to
either of these temperatures, were changed to 30.8°, and also when they
e held at either for 8 hours and then at 20° for 16 hours;

c) a temperature of 40.5° was fatal in all combinations tested.

7) Temperature and relative humidity influence the production
conidia and infection in much the same way. A temperature of 80° to
F., with a night minimum preferably not below 60°, is most favourable
to conidial production, while it is checked by a temperature of 100°
more, and is greatly checked by a range from below 50° to 80°. A maximum
humidity ranging above 60 for not less than 15 to 18 hours each day in-
xs a good growth of the fungus.

8) Because of the greater degree of moisture on the lower than on
upper side of the leaf the conidia are generally more abundant on the
er surface of the spots, but because of the action of rain and wind they
appear more rapidly from the upper surface.

7. The Susceptibility of *Phaseolus vulgaris* to Haricot Rust (*Uromyces appendiculatus*) (1). — Jokoi, E., in *Zeitschrift für Pflanzenkrankheiten*, Vol. 26,
Nos. 6-7, pp. 374-375. Stuttgart, Sept. 16, 1916.

In 1915 the writer cultivated 5 varieties of *Phaseolus vulgaris* (Ohne
sichen, Blaue Speck, Sans Viacre, Phänomen, Klosterfrauen). The three
t were grown in one field, and the other two together with the first
; in a second field.

The second field, 98 yards long by 27 yards wide, was divided into three

RESISTANT
PLANTS

(1) See *B.* August 1916, n. 933.

(Ed.).

equal parts, the first being planted with Phänomen, the second with Klosterfrauen and the third with Ohne Gleichen. By September 15, 1915 the writer had been able to prove that Phänomen was very severely attacked by rust, while Klosterfrauen on the next plot was attacked very slightly. The third plot planted with Ohne Gleichen behaved exactly like the first.

The first field planted with the three first mentioned varieties was attacked fairly severely all over.

1228 - The Resistance of Lucerne to *Pseudopeziza Medicaginis* in Uruguay
Attributed to the Use of Nitragin. — See No. 118 of this Bulletin.

DISEASES
OF VARIOUS
CROPS

1229 - Diseases and Insect Pests which Attack Rice in Java. — RUTGERS, A. A. L., in
Teymannia, Year 27, No. 6, pp. 313-342. Batavia, 1916.

Rice in Java is very considerably damaged by diseases and enemies of one sort or another. For the last four years the total loss of plantations was estimated at an average of 242 172 acres. In addition there is a considerable loss due to the decreased productivity when the rice is attacked by insects. In 1912 complete failure of the crop was caused in several parts of the island by insects. The monetary loss was estimated at about L. 200 000.

Although most of the diseases and pests have been fully investigated the relations that exist between the methods of cultivation and the attack of the pests still require further study so that means of suppressing the latter can be discovered.

Most of the mischief is done by insects; fungal diseases are not of any great importance. Diseases due to climate or to soil conditions sometimes play quite a large part.

The following pests are mentioned: 1) « Omo Mentek », root rot caused by shortcomings of the soil; to combat this disease improvement of the soil by cultivation should be aimed at; above everything stagnant water should be avoided, as it encourages de-oxidation of the soil; 2) « Omo Djene » caused by *Tilletia horrida*, only once seen in Java without doing much harm; 3) « Djamoer Parah », caused by *Ustilaginoidea virens*; the cases observed are rare and the losses inconsiderable; 4) blotches on the leaves are caused by *Napcladium*, *Helminthosporium* and *Piricularia* spp.; it remains to be proved whether the attacks of these fungi can result in a total loss of the plant; 5) *Sclerotium Rolfsii* which sometimes leads to the loss of several leaves; 6) « Omo Wereng », caused by the *Cicadellidae* or by the *Delphacinae*, which can result in serious losses; the insects attack the flowering stems which in consequence produce no caryopsis; 7) « Omo Walang sangit », caused by *Leptocoris acuta*; this insect attacks the young grain and sucks out their contents; the loss can be considerable; 8) « Omo Lenbing », caused by *Antestis histrio* (*Pentatomidae*) or by *Nezara viridula* *N. griseipennis* and *Podops vermiculatus*; these insects by attacking the stems prevent the ripening of the caryopsis; 9) « Omo Soendep », caused by *Schoenobius bipunctifer* or by *Scirphophaga sericea*, *Sesamia infernalis* or *Chilo* sp., all these insects make their way into the flowering stem where the larvae bring about a total loss; « Omo Soendep » is one of the

rst enemies of rice cultivation in Java; 10) « Omo Poetih », caused by *mphila stagnalis* or *Cnaphalocrocis jolinalis*, these insects attack the ves which they feed upon; to destroy them it is only necessary to flood rice plantations; 11) several other insects such as *Cirphis unipunctata*, *alis securis*, *Melanitis leda* and some of the *Hesperiidae*, which also feed on the leaves and at times do a good deal of damage; 12) *Tinea* sp. which lead to serious losses in stored rice; 13) *Cecidomyia* sp. and another steron hitherto unidentified which sometimes attack the nurseries; 14) *landra oryzae*, which attacks shelled rice; 15) among the mammals are s which can do a great deal of harm in the plantations, and birds also, esically *Munia oryzivora* which is a perpetual source of danger, necessitating a continuous watch being kept in the plantations when they are dry, that the intruders may be driven off.

o—On the Reappearance of Mildew (*Phytophthora infestans*) in the Haulm of the Potato. — ERIKSSON, J., in *Comptes rendus hebdomadaires des Séances de l'Academie des Sciences*, Vol. 163, No. 4, pp. 97-100. Paris, 1916.

The writer has drawn the following conclusions from his further investigations of *Phytophthora infestans*:

1) In the field the disease does not appear until 3 or 4 months after tubers are planted. In Sweden the first attack varies from the middle July to the end of September according to the weather.

2) In the first outbreak of the disease which comes at the end of summer the leaves are seen to have large, distinct, black patches especially the more vigorous ones which spring from the base of the plant, the same time the lower surfaces are covered with a fine greyish dust. the end of 2 or 3 days the black patches begin to invade the tubers. damp and misty weather encourages the growth of the fungus.

3) Where the tubers are planted in frames in January the first traces of the disease appear in the middle of April when the stems and leaves are fully developed. The tubers are at this time as well developed as are those of field grown potatoes at the end of the summer.

4) After the early appearance of the fungus in the tubers in hot weather the stems and the petioles are invaded and take on a greyish colour. the petioles often become thread-like but the blades remain green without showing any sign of the disease.

5) On the first day several zones can be distinguished in the diseased patches. Starting from the middle and radiating outwards there are: a dark brown region verging upon black; b) a velvety grey region; c) a pale yellow region free from rust; d) a region of healthy dark green which is about 10 mm. away from b.

6) In the dark green region and in the adjoining pale green part the leaves are normal, with nuclei, chlorophyll grains etc. Only the cytoplasm of the cell differs from normal cytoplasm.

With the help of powerful magnification the presence of black spots in the plasma between the chlorophyll grains has been shown. No other trace of the mycelium has been discovered either in the cells or in the adjoining spaces.

7) In the primary phases the structure of the cytoplasm of the cell undergoes changes. The grains of chlorophyll are on the verge of disintegration (chlorophyll disintegration phase) and at the same time the plasma itself is granular.

8) In the following phase the structure of the cytoplasm alters the chlorophyll grains are broken down, the whole mass of plasma seem to be more granular and contains numbers of nucleoli (4 to 6) (nucleolar phase). As a result of the disintegration of the chlorophyll the leaves turn black.

9) This phase is followed by another in which greater changes come about. The plasmic granules gather together in certain parts of the cell especially in the palisade tissue of the parenchyma. The plasmic mass of ten lies within them. Sometimes the collection of granules is found in the middle or it may lie towards the wall nearest to the epidermis. The nucleoli are replaced by cytoplasmic granules of irregular shapes (maturation phase).

10) The plasma within the diseased cell from the very beginning is of two kinds: there is the plasma of the host and that of the fungus. They are intimately mingled and form a symbiotic association which, inherited from the parent plant, spreads from cell to cell. The writer speaks of this plasmatic association as « mycoplasma ». At a certain stage in the development of the nurse-plant a struggle begins between the two, which ends in a victory for the fungus.

11) At this time the plasmic body leaves the cell and penetrates into the intercellular spaces where it begins to form the mycelium. The plasma bores through the cell wall where the granules are specially thick (mycelial stage).

The plasmic mass becomes filamentous, the filaments being either simple or branched, according to the size and shape of the intercellular space. If the plasmic mass makes its escape at the outer end of a palisade cell it becomes a fine thread which gets in between the epidermis and the cells below. At the inner end one often sees a large vesicle entirely or partly empty, its contents having been discharged into the filament.

12) The development of the mycelium seems to proceed in two directions; some remain thin and show separate nucleoli. Some of these break off from the filament as separate structures and develop into oögonia. The writer distinguishes these filaments as female. Other of the filaments increase in size and their contents are evenly distributed throughout the length. These strands branch irregularly and often give rise to forks which may develop into antheridia. These are described as male filaments.

13) Fertilisation occurs between the ripe antheridia and oögonia giving rise to an oospore. The oospores appear either singly or joined in twos and threes in the disorganised cellular tissue of the diseased part. They are spherical, 20μ to 38μ in diameter, with thick, smooth wall.

14) The oospores can germinate as soon as they are formed. They are in no sense resting spores to insure the survival of the fungus at the winter, but true summer spores whose life has a very definite duration.

15) Having reached the inner opening of a stomate the oospores develop giving rise to two or three fine branches which emerge by the stome. As soon as these filaments are formed they can produce a terminal one, ovoid or lemon-shaped, which can also develop into a longer filament with branches. Then the conidia are borne on the ends of the branches (terminal spores) or in little swellings of the filament (lateral spores).

16) The first conidia germinate as do the sporangia. Their contents differentiated into 8 distinct zoospores which are freed through an opening at the apex of the sporangium; they can begin their development as soon as they are formed. The whole evolution, from the disintegration of the lorophyll grains of the cell host to the time when the zoospores are liberated, is probably accomplished in one day. The fungus is propagated at this stage by the zoospores.

¹-The Disease of Potatoes known as "Leak", caused by *Rhizopus nigricans* and *Pythium de Baryanum*. — HAWKINS, L. A., in *Journal of Agricultural Research*, Vol. VI, No. 17, pp. 627-640, Fig. 1, Pl. XC. Washington, D. C., 1916.

The tuber-rot of potatoes known as potato «leak» is a disease of considerable importance in the delta region of San Joaquin River in California, where potatoes are cultivated on a very large scale. As a rule the disease appears soon after harvesting, in the hot weather, in warehouses during transport and it often ruins whole shipments. No exact data could be collected as to the losses but in 1915 for an area of 400 000 acres the loss probably lay between £. 10 410 and £. 31 250.

The first sign of the disease is the appearance of a small brown discoloration around a wound of some kind, such as is easily made with a hoe. In more advanced stages the entire surface of the potato is discoloured, the tissues soften and shrivel; if tubers in this condition are crushed a whitish watery liquid oozes out.

Although *Rhizopus nigricans* Ehren. can produce a tuber-rot similar to that occurring in leak, this fungus has not been isolated in field experiments from tubers affected with leak. In numerous cases *Pythium de Baryanum* Hesse has been isolated and must be regarded as the most common specific cause of the disease; inoculation experiments have given positive results. The mycelium is irregularly branched, with conidia borne either terminally or intercalarily, they are spherical with an average diameter 22 μ . They germinate as soon as they are placed in water at the ordinary room temperature. The oogonia are spherical and vary from 15 to 25 μ in diameter. The antheridia either occur on the same filament with the oogonia or on an adjacent filament. The oospores are smooth, spherical and thick-walled, with an average diameter of 16 μ .

Pythium de Baryanum is common throughout the delta region of San Joaquin River, and if infected soil is placed in contact with wounded tubers they are readily infected with the disease. As a great many of the injuries are probably inflicted with the hoe when the potatoes are dug, it care in digging is recommended, and a careful sorting out of all the damaged tubers.

1232 - *Fusarium oxysporum* and *F. trichothecioloides* in their Relation to

Tuber-rot in Potatoes.—LINK, G. K. K., in *The Botanical Gazette*, Vol. LXXII, No. 1, pp. 169-209, Fig. 1-13. Chicago, Ill., September 1916.

Fusarium oxysporum Wilcox and Link is identical with *F. trichothecioloides* Woll.

Tuber-rot and decay of the whole plant are produced by *F. oxysporum* in the same way as by *F. trichothecioloides*. The withering of the haulms is due to the destruction of the roots, and the blocking of the xylem elements in the stem; in mild cases the disease is characterised by such symptoms as discolouration and drooping of the leaves and by the appearance of aerial tubers.

In the conditions that one meets with in the field and in stores *F. oxysporum* seems to be more definitely the cause of decay than is *F. trichothecioloides*, while the latter appears to be responsible for rot in the tubers. The optimum and maximum temperatures for *F. oxysporum* are higher than those for *F. trichothecioloides* which develops well from 8° to 10° C. These facts can in part explain the different effects of the two fungi. *F. oxysporum* increases and spreads more rapidly than *F. trichothecioloides*, a circumstance which can be correlated with the greater need for oxygen shown by *F. oxysporum*, and which explains why the fungus invades the xylem elements.

The two species both possess marked powers of utilising organic matter of all kinds in their metabolism. *F. oxysporum* has this faculty in the greater degree and can make use of more varied substances than can *F. trichothecioloides*, but the destruction of the organic matter is not so complete.

The growth in *F. oxysporum* is less readily arrested than is the case in *F. trichothecioloides*. Solanine is not toxic to either species, although in the case of *F. trichothecioloides* it seems to check the growth.

1233 - *Urophlyctis Alfalfaæ* on Lucerne ("tumeurs marbrées") in France.

ARNAUD, G., in *Journal d'Agriculture pratique*, Year 80, N. S., Vol. 29, N. 17, pp. 291-fig. 58. Paris, August 1916.

The Station of Plant Pathology in Paris received specimens of lucerne from Villepreux (Seine-et-Oise) which were attacked by *Urophlyctis alfalfaæ* at the base of the stems.

The soil of the fields from which the specimens were taken was dry and permeable and owing to the lack of water was not really suitable for lucerne. The disease had developed irregularly. To check the disease it is best to plough up the lucerne in infected fields and replace it by some other crop.

1234 - *Stilbella Heveae* and *Ustulina zonata*, Pests on Rubber in Sumatra.

VRIENS, J. G. C., in *Mededeelingen van den Adviseur der A. I. R. O. S.*, No. 5, pp. 66-67. Medan, 1916.

The mycelium of *Stilbella Heveae* spreads out into fine white threads over the young shoots and leaves of the rubber tree. Soon the leaves which have been attacked lose their colour and die, and are left hanging on the branches by threads of the mycelium.

The writer has been able to show that the disease can be stamped out.

by gathering together and burning the infected stalks and leaves. The damage caused by the disease is comparatively insignificant.

In the same paper there are reports of two cases of *Ustulina zonata* on rubber at Deli (Sumatra).

In the Federated Malay States this fungus does a great deal of harm in rubber plantations as SHARPLES has recently stated (1). It attacks the wood, having effected its entrance by means of the holes made by mining insects or by other wounds. This disease is probably very contagious.

As a means of prevention the writer advocates the removal of all dead wood that could shelter insect pests from the plantation.

(135) — *Botrytis (cinerea?)* and *Rhizopus (nigricans?)* as the cause of Rot in Strawberries in the United States. — STEVENS, N. E., in *Journal of Agricultural Research*, Vol. VI, No. 10, pp. 361-366, Pl. XLIX-L. Washington, D. C., 1916.

Strawberries sent out from the Southern States are very often spoilt by *Botrytis (cinerea?)* and *Rhizopus (nigricans?)*, which cause rot during shipment and on the market. The pathological processes are very different in the two cases.

Botrytis sp. — The mycelium penetrates into all parts of the berry, fills up the intercellular spaces with a network of hyphae which surrounds the cells and tissues so that the berry keeps its shape and only undergoes slight shrinkage without much loss of juice.

The hyphae readily dissolve the middle lamella and are able to penetrate into the cells where they very quickly bring about the disintegration of the protoplasmic contents so that the nucleus can no longer be distinguished.

Rhizopus sp. — The berries become flattened and there is a considerable loss of juice. The mycelium of the parasite normally develops quite near the surface of the berry in the outer 6 or 8 cell layers, and only very rarely does it make its way into the cells.

The nuclei of the cells persist in apparently normal condition until the cytoplasm has almost entirely collapsed. Under very dry conditions (desiccator with concentrated sulphuric acid) *Rhizopus* sp. develops to such an extent that it extends to the middle of the berry; in this case the hyphae are often found inside the cells.

It is rare to find both parasites in the same berry. But often *Botrytis* sp. is found with *Fusarium* sp. or with *Alternaria* sp., or *Rhizopus* sp. is found with *Fusarium* sp. In these cases the two mycelia mingle in the tissues of the berry, but they may also occupy two distinct zones with a marked zone of division as is the case with *Botrytis* sp. and *Alternaria* sp.

It is possible that *Rhizopus* sp. can occur in a region originally infected by *Botrytis* sp. or by some other fungus. The writer's researches however point to the conclusion that *Rhizopus* sp. is not dependent upon the presence of any other fungus in its attacks on strawberries during shipment or on the market.

(1) See *B.* July, 1916, No. 812.

(Ed.)

WEEDS AND PARASITIC FLOWERING PLANTS.

1236—Researches on the Dodder of Flax (*Cuscuta Epilinum*) in Germany.
OBERSTEIN, in *Illustrierte landwirtschaftliche Zeitung*, Year 36, No. 78, pp. 525-54
Berlin, Sept. 27, 1916.

Hitherto dodder has only appeared to a slight extent upon flax in Germany. In the literature of the subject there are records of its appearance in large quantities in Saxe-Altenbourg (1904), in Bavaria (1905-06) in the Grand-Duchy of Reuss, in West Prussia and in Posmania (1908). During the last year it has also been reported from Silesia having probably been imported with flax from Russia (1).

The writer profited by this opportunity to investigate the germination of the seeds and the question of their different plant hosts. The work was carried out in the Seed Testing Station of the Silesian Chamber of Agriculture. On 13 April 1916, 100 seeds of dodder were sown and allowed to germinate in 4 sets of sterile sand. After 3 days 29, 30, 19 and 39 per cent of the seeds had begun to germinate; 3 days later the percentages were increased by 15, 15, 19 and 5 respectively; 10 days after sowing the percentages of seeds which had germinated were 45, 48, 51 and 44. A germination experiment carried out at the same time with *C. Trijolii* and *C. racemosa*, but using the method employed for clover, gave the following results: with *C. Trijolii* the maximum number of seeds which had germinated after 24 hours was 2 per cent; while with *C. racemosa* the percentages were 4, 8, 4 and 9 after 5 days and 18, 25, 16 and 26 respectively after 24 days.

All these experiments therefore confirm the opinion which is generally held, namely, that the dodder of flax, owing to its relatively long germination, is well adapted to the short duration of its principal plant host.

Pot experiments with dodder seeds gave flourishing plants from June and July onwards; they developed equally well on red clover and on flax although the former appears to suit them less well. The red clover however suffered less than did the flax which was often completely choked during the course of its growth. Good flowers were only obtained when the flax was slightly attacked by dodder. The dodder flowers equally well on red clover and on flax if the pots are watered from time to time.

Dodder which was grown on red clover produced ripe seeds just as it does on flax. Ripe seeds were also obtained from dodder on *Lathyrus Aphaca* and on *Vicia hirsuta*, which had accidentally found their way into the pots with the flax.

The results embodied in this paper are not in entire agreement with those obtained by previous workers so that further work upon the subject is still required.

(Ed.)

137 - Seeds of Weeds and of Cryptogamic Diseases observed in Sowing Cereals from the Maritime Province of Eastern Siberia. — See N° 1174 of this Bulletin.

138 - An Attempt to Destroy Wild Mustard (*Brassica Sinapistrum*), in Fields of Cereals. — DUSSERRE, C., in *Travaux de Chimie alimentaire et d'Hygiène*, Vol. VII, Part 6, pp. 357-358. Berne, 1916.

In order to replace the sulphates of iron and copper, and powdered alumite, which have been used hitherto to destroy wild mustard and are now expensive and difficult to procure, the writer made experiments in May with a 20 to 30 per cent solution of potassium chloride, which can be procured in sufficient quantities at its original price. Trial was made on April 28, 1916 on an oat field at Ecublens (Vaud), which was overgrown with wild mustard, the plants having 2 or 3 leaves unfolded. The result was very satisfactory; the plants touched by the liquid were completely shrivelled up; the few which had received less of the solution withered and appeared to be very sickly. The field in this way was cleared of this weed and the oats developed vigorously. Plants of *Ranunculus sceleratus* which were common in the field were also destroyed.

The writer suggests that more concentrated solutions should be employed (55 lbs. of a 30 per cent salt in 22 gallons of water) and that it should be sprinkled on to the plants by means of a vine sprayer on a fine morning after heavy dew. For a field that is badly infested one must reckon about 52 lbs. of salt dissolved in 1092 gallons per acre; the solution is prepared simply by placing the proper amount of the solid in a bag and suspending in the measured amount of water. This treatment has no bad effect upon the cereal and represents, in fact, a very fair amount of potash manure, which can only have beneficial effects upon the harvest.

INJURIOUS INSECTS AND OTHER LOWER ANIMALS.

139 - Animal Pests on Cultivated Plants Observed by the Entomological Bureau of Stavropol in 1914. — UVAROV, B., in *Rapport sur les travaux du Bureau entomologique de Stavropol au Caucase pour l'année 1914*, pp. 102-105. Petrograd, 1916.

GENERALITIES

The most important among the insects which are pests upon cultivated plants in Stavropol is the migratory locust (*Pachytalus migratorius*) which was observed in 1914 in only one single locality on the River Suna. This insect has been completely destroyed by repeated sprayings begun in 1908 under instructions issued by the Bureau, 1914 being the last year in which the treatment was used. In addition to this method of dealing with *Pachytalus* experiments have been made using baits of bran and meal poisoned with potassium arsenite. These experiments have given splendid results. Besides this two sprayers have been tested: a horse drawn machine and a knapsack sprayer. The latter has been found to be the more convenient for the migratory cricket.

Observations upon harmful insects have been made by the staff of the Bureau during their tours, and at two places in the district temporary laboratories have been equipped to the same end, thus a great number of

pests have been observed which have escaped notice in previous years and more detailed investigations of the ones already known have been made.

Among Arachnoidea, *Bryobia ribis* Thomas, which attacks gooseberry bushes in the spring, has been seen for the first time.

Thrips linearis Uzel has damaged flax to a considerable extent.

The following Hemiptera have been recorded for the first time on fruit trees and shrubs in orchards: *Mezocerus marginatus* L., *Rhyparochromus chiragra* F., *Calyptonotus rolandri* L., *Drymus sylvaticus* F., *Piesma maculata* L., *Monanthia echii* Schre. and *Lugus rubicundus* Fall., on flax, *Coccophorus lunulatus* Goeze and on lucerne, *Brachycoleus scriptus* Fl., *Aphocoris vandalicus* Rossi and *A. ticingensis* Mey. The Cicadas collected have not yet been identified by the Bureau; a great many specimens of *Dolichopodus* sp. and *Cicadula* sp. have been found on cereals. A certain number of plant lice have been recorded, and some species have been noted: *Cacopsylla populi* L. (on white poplars); *Sitobion cereale* Kaltb., *Aphis* sp. *noxia* Mordwilko n. sp., *Aphis* sp. (all the three preceding forms from cereal crops); *Rhopalosiphum ribis* Buct., (on gooseberries); *Aphis pruni* Walk. (on plums); *A. vitis* Scop. (on vines); *A. craccivora* Koch (on lentils); *A. persicae* B. de F. (on peaches and almonds); *A. crataegi* Kaltb. (on the apple). Of the Coccoidea, *Phenacoccus aceris* Sign. (*Dactylopius* sp. Licht.) has been found in cracks in the bark of apple trees.

Among the Lepidoptera, *Lymantria dispar* L. has been increasing with great rapidity in the valley of the Kouna and has caused a great deal of damage. Two caterpillars (*Heliothis dipsacea* L. and *Phalonia quinana* Zell.) have attacked flax; the first was studied by SHAMRAY and the existence of two summer generations has been established. The following species have been observed this year for the first time: *Pieris rapae* L., whose caterpillars cause havoc among the plants of white mustard; *Deilephila lineata* F. var. *livornica* Esp., on the vine; *Poecilocampa populi* L., on *Populus pyramidalis*; *Gastropacha quercifolia* L., on the plum; *Acronycta tridens* Schiff., on the apricot; *Cucullia santonici* Hb. on sunflowers; *Eubolia arenacea* Hb., in great numbers on lucerne. The Non-lepidoptera pests have been the objects of very detailed work, and a certain number of species have been recorded which had not been described. Such are: *Sarrothripus revayana* Sc., on the poplar; *Cledeobia moldavia* Esq. (the caterpillars were abundant in the steppes); *Pionea jorifalis* L. on cruciferous plants; *Tortrix viridana* L., whose caterpillars have done a great deal of harm to the oaks in Stavropol and its surroundings; several species which principally attack fruit trees, such as: *Acalitus miana* L., *Cacoecia podana* Sc., *C. rosana* L., *Pandemis ribcana* Hb., *P. parana* Schiff., *Steganoptyla* sp., *Gelechia rhombella* Schiff., *Coleophora nigricella* Stgh.

The staff of the Bureau have devoted especial care to the life histories of the Curculionidae that attack fruit trees. The most important of these are: *Otiorrhynchus aurosparsus* Germ., *Phyllobius oblongus* L., *Scaphisoma squalidus* Gyll. and *Anthonomus pomorum*. The principal plant host

he first of these which destroys the shoots, flowers and leaves of fruit trees, is the stinging nettle according to GLAUSOUNOFF, so that well kept gardens are free from it; the reproduction in this, as in the allied species of *Otiorrhyncus*, is parthenogenetic. A more detailed account of two Coleoptera has been given, both of them being pests on mustard: *Colaphus witti* Men. and *Lixus ascanii*; the former has only one generation of larvae in the summer and hibernates in the adult state; the latter, it appears, has two larval generations and it is the larvae which hibernate. The following Coleoptera are now reported as being harmful: *Podonta* sp., on the lower ears of corn; *Lina populi* L., on poplars all along the River Kouma; *Otiorrhyncus ligustici* L., which is a serious pest on lucerne; *Phyllopus pyri* L., on *Ulmus*; *Eudiphus micans* F., also on *Ulmus*; *Psalidium naxillosum* F., on mustard; *Cleonus punctiventris* Germ. and *C. nigritulus* Pall. var. *kindermanni* Est., on mangolds; *Ceutorrhynchus macula-alba* Erbst., which causes great damage to poppies; *Baridium scolopaceum* Germ., on mangolds; *Rhynchos giganteus* Kryn. with other allied species in fruit trees; *Blitophertha lineata* Fbr., which injures the leaves of haricot beans and is also found, with species of the genus *Anisoplia*, on the ears of wheat.

Among the Diptera large number of *Contarinia tritici* Kirby have been seen, which have not done much harm.

Important among the observations on the Hymenoptera are the records damage done to maize shoots by ants, and GLAUSOUNOFF's researches on the Tenthredinidae of cereals (*Cephus pygmaeus* L. and *Trachelus tardus* L.). These two species are evenly distributed throughout the region and it is of practical as well as theoretical interest to discover what are the agnostic features of their larvae. A study of the external characters is less in this connection, but there are great differences in the form of the k-producing glands; a detailed description of the morphology and anatomy of these larvae will be published in a separate paper. The following Hymenoptera pests are recorded for the first time in this region: *Xylopa violacea* F., which has done a good deal of harm to the wooden constructions in the villages; *Eurytoma amygdali* End., in the kernels of plums; *Aplochaetpa tulvicornis* Kl., in plums; *Athalia spinarum* F., on cabbages and mustard.

Besides the harm done by insects, very serious damage has been caused by field mice (probably *Microtus* sp.) which occur in great numbers in the south of the Government, and in certain places have destroyed the seedlings of cereals. The number of ground-squirrels (*Spermophilus* sp.) increases each year and the methods used for their destruction are inadequate owing to the lack of the necessary resources.

Insect Pests of Agriculture in British East Africa. — DEAKIN, R. H., in *The Annals of Applied Biology*, Vol. II, No. 4, pp. 241-244. Cambridge, 1916.

During the year 1914 large bands of *Schistocerca peregrina* some in the adult and some in the larval condition appeared throughout the Protectorate; the damage done was not extensive, only a few plants of coffee and of maize being attacked.

Among the pests that attack coffee *Antestia variegata* is the most serious; however, according to the writer, the development of this insect is checked by the presence of a Chalcid, hitherto unidentified, which is parasitic on its eggs. The Chalcid lays an egg in each of the eggs of the *Antestia*, and the number of infected eggs often exceed 50 per cent. The writer suggests that the development of this Chalcid should be encouraged and that it should be introduced into regions where at present it is unknown.

Coffee is also attacked by *Lecanium nigrum*. A great many individuals of this species fall a prey to parasites. Other pests are *L. africanum* and *Euxoa segetum*. To keep the latter in check the soil must be kept free from weeds and intelligent use should be made of poisoned baits

The following have been recorded from Citrus plants: *Argyrolea cotrela*, whose larvae attack ripe oranges; *Icerya purchasi*, which does not appear likely to be serious in the Protectorate; little Coleoptera (*Halticinae*?) appeared suddenly in numerous swarms in a Citrus plantation the young leaves of the plants were seriously injured; *Papilio machaon* whose caterpillars destroy the leaves of oranges; a little mite which is not yet identified, has been recorded as a pest on oranges.

Eriosoma lanigera has been observed on apples; winged individual have not yet been seen.

The leaves of quince-trees have been seriously damaged by the larvae of *Orgyia vetusta*, of which an ichneumon fly is a useful natural enemy.

The larvae of *Duomitus capensis* bore through the branches of the indigo plant (*Cassia didymobolyra*) and kill them.

The writer has discovered a new enemy of Black wattle (*Acacia de currens*); this is believed to be the larva of a Buprestid, but an adult individual has not yet been found. The larvae, which emerge from eggs laid on the trunk and branches bore into the cambium and, if they are numerous kill the tree. The best means of combating this pest is to fell the tree that are attacked and strip off the bark, and moreover to remove all the trees which seem to be in poor condition.

Two Hemiptera belonging to the families *Jassidae* and *Capsidae*, also cause very serious injuries to the same *Acacia*.

1241 - Species of *Aleyrodidae* which are Harmful to Citrus and other Plants
Various Countries. — QUANTANCE, A. L., in *Journal of Agricultural Research*, No. 1 pp. 459-472, fig. 1-3, Pl. LXIV-LXIX. Washington, D. C., 1916.

1) *Aleurocanthus citricolus* (Newstead), discovered on *Citrus* sp. 1 Dares-Salaam (German East Africa); 2) *A. citriperdus* n. sp., a pest of *Citrus* spp. in Ceylon, in India (Lahore), in Java (Buitenzorg and Sande Glaya); *A. woglumi* Ashby (spiny citrus white fly) observed in India, the Phillipine Islands, Ceylon, Jamaica, Cuba, and the Bahama Islands; plant hosts so far established: *Citrus* sp. (Lahore, Guiranwala, Kalimpong Sikkim (India), and Kingston (Jamaica), orange (India, Manilla, Jamaica, Cuba and the Bahama Isles); *Capparis Roxburghii* and *C. pedunculosa* (in the Botanical Garden of Ceylon); *Morus* sp. (Lahore); *Salacia reticulata* and *Kurrimaia zeylanica* at Peradeniya (Ceylon); *Guaiacum officinale* and *Cestrum nocturnum* L. (at Kingston); undetermined plant hosts (India).

4) *A. spiniferus* (Quaintance), on *Citrus* sp. and on roses at Garalt (Java) and on oranges at Macao (Southern China); 5) *Aleurolobus marlatti* (Quaintance), on *Citrus* sp. and *Morus* sp. at Lahore; on *Ficus* sp. in the Ceylon Botanical Garden; on oranges at Tokyo and at Kumamoto (Japan), etc.; on an unknown plant in the Buitenzorg Botanical Garden (Java); 6) *Aleurothrixus floccosus* (Maskell) common in the following localities: West Indies, Florida, Mexico, British Guiana, Brasil, the Argentine, Chili and Paraguay; not only seen on the orange (Mexico) and on *Citrus decumana* and *C. Limetta*, but also on the sea grape (*Coccoloba uvifera*), *Plumeria* sp., *Baccharis genistelloides*, *Psidium Guajava*, etc.; 7) *A. howardi* (Quaintance) on the same hosts and in the same localities as *A. floccosus*; 8) *A. steri* n. sp., on the orange at Santiago, Ransaguita, San Bernardo (?) hills; on *Schinus dependens* at Santiago; on *S. molle* in Chili; on *Lippia riadura* and *Myrtus* at Santiago; on an unknown *Solanum* at Villa del Ar (Chili) and on *Eugenia caulinflora* at Rio de Janeiro (Brasil); 9) *Bemisia flandi* (Kotinsky) on *Citrus* spp. in several gardens in Honolulu (Hawaii); here it has probably been introduced, most likely from India, where it is been observed on an unknown host plant at Lahore; 10) *Dialeurodes tri* (Ashmead), the so-called Citrus white fly, one of the most harmful pests upon citrus plants in Florida (where it has been known since 1880), and in all the States along the Gulf of Mexico; recorded also from Colorado, Illinois, the Columbia District and California, and also from Mexico, Chili and Brasil; without doubt this form is of eastern origin, being found in numerous localities in India, Ceylon, Japan and China; in Florida it occurs not only on *Citrus*, but also on *Melia Azedarach*, *Gardenia jasminoides*, *Igustrum* spp., *Diospyros Kaki*, *D. virginiana*, *Syringa* sp., *Coffea arabica*, *Ficus nitida*, etc.; 11) *D. citrifolii* (Morgan), known in North Carolina, Mississippi, Louisiana, California, Florida, Cuba and Mexico; besides being found on *Citrus* spp. it has also once been recorded upon *Ficus nitida* at Audubon Park, New Orleans; 12) *Paraleyrodes perseae* (Quaintance), known only in Florida on oranges, *Persea americana* (avocado), *Persea* spp. and perhaps also on persimmons (*Diospyros* spp.); 13) *Trialeurodes floridensis* (Quaintance) in Florida on *Anona squamosa*, *Persea americana*, *Psidium Guajava* and on the orange; but probably its attacks on the latter are of little importance; 14) *T. vitrinellus* (Cockerell) on the orange in Mexico, and on oaks in California; here again the orange is probably it seriously damaged; 15) *Tetraleurodes mori* (Quaintance), a species which is indigenous to the eastern United States and is widely spread throughout them, attacking a great many plant hosts: (Mulberry-tree, *Salanus occidentalis*, *Acer*, *Cornus*, *Celtis occidentalis*, *Diospyros* spp., *Kalmia*, etc.); recorded from Arizona and Mexico on oranges, where its parasite is a race rather than a variety of *T. mori*, to which the name *arizonensis* (Cockerell) has been given.

1242 - *Diestrammena marmorata* (*Tachycines asynamorus*), an Orthopteran from German Greenhouses. — EBNER, R., in *Centralblatt für Bakteriologie, Parasitenkunde und Infektionskrankheiten*, Vol. 45, No. 18-25, pp. 587-594. Jena, June 19, 1916.

For several years a strange Orthopteran has occurred in greenhouses in Germany, which is known either as *Diestrammena marmorata* de Haan or as *D. unicolor* Brunner. In 1913 BOUDYREV established the fact that *Diestrammena* from Central Germany is identical with *Tachycines asynamorus* Adel. which is found in greenhouses in Petrograd. The writer has obtained several specimens from a greenhouse in Vienna which were identified as *T. asynamorus*. It is not known to what country this insect is indigenous, but most probably it was imported into Europe from America.

It was recorded for the first time in 1891 by KREJCI at Prague, and it has been known in hothouses in Hamburg since 1892. Later it has appeared in Saxony and in Thuringia, and notably in Kiel, Lübeck, Wandsbek, Münster, Berlin, Breslau, Frankfort o. M., Leipzig, Dresden, etc. It has also been found at Brussels (ADELUNG), Lille (1913), Paris (CHOPARD, 1913), in England (Kew Gardens, St. Leonard's and Ipswich, 1910-1913) and in Denmark (Frederiksberg). In almost all these places it has been described under the name of *Diestrammena*, but undoubtedly it is identical with *Tachycines*. In Austria it has only been reported from Prague and Vienna.

The insect only comes out at night when it is very active, being able to jump to a height of $19 \frac{1}{2}$ inches. During the day it hides itself in pots or in cracks in the walls of the greenhouse. While the larvae are mouthing they hang freely in the air suspended by the posterior end of the body.

When the insects are captured a brown liquid is excreted from the mouth. In summer they often leave the greenhouse during the night but never for long. The same thing has been observed in *Troglophilus* (an insect which lives in dark places) and the writer concludes that the two insects belong to the same group. But as *Tachycines* only inhabits greenhouses and never cellars, CHOPARD considers that a uniform temperature and a high degree of moisture are more essential than darkness.

Reproduction goes on all the year round, but more especially in the spring. According to BOUDYREV and GERHARDT copulation takes place at night. The female lays 1 to 50 eggs a night and altogether several hundreds are laid. The eggs are oblong and about 2 mm. long by 1 mm. wide. The behaviour of the young larvae is exactly like that of the adult insects.

The food principally consists of animal matter, but according to LUDWIG and EBNER it is probable that vegetable material also can be utilised.

The writer believes that this insect does more harm than is generally supposed, but unfortunately no satisfactory methods of dealing with it are known. Great cleanliness in the greenhouses is recommended and also fumigation with sulphur vapours and with carbon bisulphide.

Several investigators recommend spraying the plants with Schweinf-

rth's green, but the writer considers it scarcely probable that this method will destroy the eggs in the ground.

In conclusion it is suggested that a further study of the origin and history of *Tachycines* should be made, and that further experiments on preventive methods should be undertaken.

43.-**New Species of Braconid Hymenoptera, Parasites of Tripanids Diptera in India.** — SILVESTRI, F., in *Bollettino del Laboratorio di Zoologia generale e agraria della R. Scuola superiore d'Agricoltura in Portici*, Vol. XI, pp. 160-169, Fig. I-VI. Portici, September 27, 1916.

A description is given of the following new species of Braconid Hymenoptera which are parasitic on Tripanids collected from various localities in India by THOMAS BAINBRIGGE FLETCHER :

- 1) *Bracon fletcheri* n. sp., obtained from fruits of *Zizyphus Jujuba* am., which were attacked by *Carpomyia vesuviana* A. Costa ;
- 2) *Opius fletcheri* n. sp., obtained from the pupae of *Chaetodacus acuruitae* Coquillett, whose larvae live in the fruits of *Momordica Charantia* L.
- 3) *O. incisi* n. sp., at Pollibetta, Southern Coorg, obtained from the pupae of *Chaetodacus incisus* Walk., living in fruits of *Careya arborea* Roxb. (ak fruit) ;
- 4) *Biosteres carpomyiae* n. sp., at Pusa, obtained from pupae of *Carpomyia vesuviana* A. Costa ;
- 5) *B. persulcatus* n. sp., in northern and southern Coorg, obtained from pupae of *Chaetodacus incisus* Walk. ;
- 6) *B. compensans* n. sp., in Coorg, obtained from pupae of *Chaetodacus incisus* Walk., living in the fruits of *Careya arborea* Roxb.

44.-**The Green Lacewing Fly (*Chrysopa californica*), a Natural Enemy of Insect Pests in the United States and in California.** — WILDERMUTH, V. J., in *Journal of Agricultural Research*, Vol. VI, No. 14, pp. 515-525, Fig. 1-7. Washington, D. C., 1916.

The larvae of *Chrysopa californica* Coquillet destroy large numbers insects which are parasitic on cultivated plants notably: clover mite (*Erythraea pratensis* Garman), two spotted mites (*Tetranychus mytilaspidis* Ley), red spider (*T. telarius* L.), apple leafhopper (*Empoasca malii* Leon), grape leafhopper (*Typhlocyba comes* Say), Pear Psylla (*Psylla pyri* Foerster), mealy plum plant louse (*Hyalopterus arundinis* Fabricius), melon aphis (*Aphis gossypii* Glover), black peach aphis (*A. persicae* Erwin Smith), green Citrus plant louse (*Macrosiphum citrifolii* Ashmead), Citrus mealy bug (*Pseudococcus citri* Risso), frosted scale (*Eulecanium cinnabarinum* Coquillet), red scale (*Chrysomphalus aurantii* Maskell), purple ale (*Lepidosaphes beckii* Newman), wheat thrips (*Euthrips tritici* Fitch), citrus mite (*Notophallus viridis* Banks), green bug (*Toxoptera graminum*ondani), and corn leaf aphis (*Aphis maidis* Fitch).

Every female lays about 30 eggs, each one being supported by a slender stalk; the eggs are hatched at the end of 6 to 12 days. The larvae pass through two molts which divide the larval period up into three stages, occupying 11 to 22 days, the average time being 16 days.

The larvae are very voracious, each one being able to dispose of 74 to

160 aphids. The time occupied by the pupal stage varies according to the season; in March it lasts from 14 to 23 days, the average time being 16 days, and in November the limits are the same but the average is 20.

This species of *Chrysopa* has six generations annually; the first from February 15 to March 15, and the others following on at intervals of 40 to 45 days until late into the autumn.

This insect is common and widely distributed in the States bordering on the Pacific, Texas, Arizona, New-Mexico, Nevada, southern California and possibly in Utah. Among its natural enemies the chief are the western wood pewee (*Contopus richardsonii*) and the nighthawk (*Chordeiles virginianus*).

1245 - *Signiphora merceti* n. sp., a Natural Enemy of the Cochineal Insect *Chrysomphalus dictyospermi* in Spain (1). — MALENOTTI, E., in *Redi*, Vol. XII, No. 1, pp. 181-182. Florence, September 21, 1916.

A systematic description of a new Chalcid, *Signiphora merceti*, obtained by breeding specimens of *Chrysomphalus dictyospermi* from Spain.

Three females of this Chalcid have been examined, but the male is still unknown. The new species is named after MERCET the entomologist.

1246 - Observations upon *Icerya purchasi* and its Natural Enemy *Novius cardinalis* in Sicily (2). — DE GREGORIO, A., in *Il Naturalista Siciliano*, Vol. XXII N. S., Nos. 1-6, pp. 5-17, Pl. I-IV. Palermo, 1916.

Icerya purchasi Mask. has recently been found at Villabate (Palermo) and the writer has been able to follow out the various stages in its development.

The larvae are able to move with great force and rapidity, and moreover they can be kept alive for several days without food.

The writer confirms the statement that *Novius cardinalis* Muls. is very useful in keeping down the numbers of *Icerya*. He introduced specimens of *Novius* at Villabate which had been received from the Zoological Laboratory at Portici (Naples). Other specimens had previously been introduced at Bagheria (Palermo), and the writer believes that they have multiplied with great rapidity and had helped on the destruction of the cochineal insects at Villabate. He also thinks it probable that another of the Coleoptera, *Chilocorus bipustulatus* L., is useful in the same way and has also helped to stamp out *Icerya* at Villabate. The development of *Novius* is described in this paper. The statement that the adults feed upon the eggs and young larvae of *Icerya* is contradicted.

The writer has shown that the young larvae of *Icerya* are quickly killed by spraying the under surfaces of the leaves of the plant host with soap-suds.

1247 - Prevention of the Hessian Fly (*Cecidomyia destructor* = *Mayetiol destructor*) in Kansas by Choice of the Season for Wheat Sowing. — S. No. 1179 of this Bulletin.

(1) See also *B.* October 1916, No. 1140.

(Ed.)

(2) See also *B.* May 1913, No. 621.

(Ed.)

1925

***Helopeltis* and its Relations to Cacao Tree.** — ROBERT, W., in *V. Nederlandsche Tropenstation Midden-Java*, No. 21, Batavia, 1915.

During the years 1901 and 1902 a very severe drought in Central Java was accompanied by the presence of *Helopeltis* on Cacao trees. During the following years when there were heavy rains the pest was much less severe, but it again became serious during the years 1913, 1914 and 1915 which were unusually dry. The harm done led the writer to resume his researches on *Helopeltis*.

There are two species, *H. antonii* and *H. theivora*, which attack cacao plantations. They resemble one another closely both in life history and in the damage they do.

The female lays her eggs in parts of the tree where there is abundant moisture, i. e. in the rind of the fruits, the young shoots, or even in the parts of the stems which are not woody. Soon, a black patch appears at the place where the eggs are laid, caused by necrosis of the surrounding tissues. After 6 days the larvae hatch out and scatter over the branches in search of food. Ten days later they are mature.

The places at which the insect feeds soon turn black and normal growth ceases. The writer gives a list of the trees attacked by *Helopeltis*, in which both wild and cultivated trees figure.

Helopeltis flourishes best in shady damp places, and for choice attacks trees which are not exposed to the sun. An account is given of the conditions which favour the insects' dispersal and also of the relations that exist between ants and *Helopeltis*.

For more than 10 years the writer has observed that whenever the black cacao ants (*Dolichoderus bituberculatus*) occur in great numbers *Helopeltis* disappears. He therefore suggests that the pest should be dealt with by encouraging the presence of these ants in the plantations by providing them with suitable nests hung from the trees. Another effective way of checking the spread of *Helopeltis* when the attack is not severe is by catching the insects.

Where the attack is widespread and the insects are numerous it is a good plan to burn the fruits and the stalks.

250 — ***Eurytoma* sp., an Hymenopteran Pest on Almond Trees in Palestine.** —

ABARONI, J., in *Der Tropenpflanzer*, Year 10, No. 6, pp. 317-322, Berlin, 1916.

The larva of *Eurytoma* sp. causes very extensive damage to almond trees in Palestine, 50 per cent of fruits being destroyed every year.

When an almond is attacked it turns first brown and then black and is in consequence unsuitable for food. The larva does not live at the expense of one of the enemies of the almond tree but by destroying the fruits themselves. However in 600 blackened almonds 3 larvae of one of the Microlepidoptera have been found and one of a Curculionid, but it is not likely that they were hosts of the *Eurytoma* larvae. Nevertheless the writer does not believe that the presence of *Eurytoma* alone causes the blackening of the almonds, for many fruits which are black outside contain a normal, healthy kernel.

After the flowering season of the tree (end of February to beginning of March) the adult insect leaves the almond to attack the ovaries of new fruits. Almonds with two kernels invariably contain two larvae.

The writer has never found an egg of *Eurytoma* though he has examined numerous fruits; towards the end of May the fully grown larvae have already appeared.

The white larva is blind, without legs, with the head but slightly developed and a body which is round in the middle but pointed at either end. When it is taken from the fruit and exposed to the sun it rolls up and dies, which proves that it cannot bear the direct rays of the sun. Inside the body a green liquid is produced, both in the larvae feeding on the green almonds and on the ripe white kernels. Apparently these larvae have great powers of resistance against changes of climate for all those raised in the laboratory developed quite normally. Only 1 per cent of the larvae in the fruits were dead. This insect seems to have few natural enemies which explains why it has been able to invade Palestine to such an extent. The varieties most liable to attack are Victoria and Princess, both of them bearing fruits with soft shells.

In the Arabian almonds with hard shells the writer has discovered other pests, notably the larvae of one of the Diptera. *Eurytoma* seems to prefer the old trees.

When the harvest time arrives (middle of July to beginning of August) the kernel has been completely eaten, but the larva remains in the almond until the following spring (February or March); it resists the winter cold quite well.

Experiments have been conducted to determine what influence temperature has upon the insect's development. If almonds containing larvae are kept in a dark place at a temperature of 17°-18° C., the adults are hatched out at the end of May instead of in February or March. Generally hatching takes place between 8 and 9 in the morning when it is very hot. The insects secrete a liquid to dissolve the shell of the fruit, and this makes a hole through which the adult insect emerges. The females make larger holes than the males, which perhaps affords one means of distinguishing between the sexes.

When there are two kernels and each contains a larva, the insects come out by two different holes. The writer has sometimes found that one kernel contains an adult insect just about to hatch out, while the other contains quite a young larva. Therefore it is evident that the two eggs were deposited by different insects.

Loss of juice from the almond does not hinder the insect's development.

The pupal stage lasts on an average for 2 or 3 weeks; during this time the white grub gradually turns black.

The insect can only be kept in check by picking and burning all the fruits which have turned black, but from which the adults have not yet escaped.

1251 - *Blastophaga ghigii* n. sp., and *Pleistodontes froggatti*, Chalcid Hymenoptera from Australia Living on the Fruits of *Ficus stenocarpa* and *F. macrophylla* Respectively. — GRANDI, G., in *Bullettino del Laboratorio di Zoologia generale e agraria della R. Scuola superiore d'Agricoltura in Portici*, Vol. XI, pp. 145-159, Fig. I-V. Portici, September 7, 1916.

The writer describes from the systematic point of view two Chalcids collected in 1912 by F. SILVESTRINI in New South Wales:

1) *Blastophaga ghigii* n. sp., living in the fruits of *Ficus stenocarpa* F. Muell., at Narara; the female is not known;

2) *Pleistodontes froggatti* Mayr., which lives in the fruits of *F. macrophylla* Desf., at Sydney.

1252 - *Eriophyes* n. sp., a Mite Pest on Litchi (*Nephelium Lit-chi*) in the Hawaiian Islands. — O' GARA, P. J., in *Science*, N. S., Vol. XLIV, No. 1126, p. 142. Lancaster, Pa., 1916.

In the grounds belonging to the United States Experimental Station at Honolulu a plant of *Nephelium Lit-chi* Cambess. (= *Litchi chinensis* Sonn.) was seriously attacked by a mite, recognised later as a new species of *Eriophyes*.

In some cases the whole of the under surface of the leaves was attacked, but more often the disease appeared in distinct patches. Leaves which were severely attacked resembled peach leaves which have fallen a prey to *Exoascus deformans*.

The appearance of this pest always seems to be unexpected, it is never reported until the signs of its presence are well established.

Hitherto no other mite has been recorded upon *N. Lit-chi*; and moreover very few mites are recorded from China to which this tree belongs. It is possible that although *N. Lit-chi* is imported from China it has been attacked later on by a mite which is indigenous to the Hawaiian Islands.